NATIONAL AIR TOXICS MONITORING STRATEGY

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Table of Contents

Table of Tables

1. Extended Summary

Background. This document is intended to serve two principal purposes. First, it provides a relatively comprehensive summary to date of the national air toxics monitoring program that started in 1998 and describes some of the major findings that currently shape program evolution as well as insight into a spectrum of technical and logistical issues underlying program implementation. Second, the report comments on the expected short and long term products providing direction for agencies participating in the national program. This report should be viewed as a current status of the air toxics monitoring program, understanding that the program evolution is based more upon historical and forthcoming findings, than a prescriptive a priori vision. Accordingly, this is a living document that will be adjusted over time continually reflecting status and direction of the national air toxics monitoring program.

The national air toxics program. The national air toxics program includes several complementary programmatic and technical elements that ideally provide mutually supportive roles. Programmatically, air toxics components include the maximum achievable control technology (MACT) standards, residual risk standards, area source standards, mobile source rules, utility mercury reductions rule, local scales and Great Waters. In concept, MACT is a technology based emission reduction program targeting sources emitting greater than 10 tons/year of a single air toxic pollutant or 25 tons/year of multiple air toxic pollutants. Residual risk complements MACT rules by assessing actual exposures after MACT is imposed, and providing recommendations for added reductions. Area source standards address sources smaller than those covered by MACT. Mobile source rules which are motivated principally by the ozone and PM programs create significant reductions in volatile organic compounds that classify as hazardous air pollutants (HAPs.) Recently, rules were developed to reduce mercury emissions from major utility sources through a market trading approach somewhat analogous to the sulfur dioxide trading program in the Clean Air Act. Local scale projects are intended to provide a more locally driven proactive approach to reducing air toxics exposures apart from the more restricted regulatory rules. The Great Waters program addresses welfare of major watersheds and water bodies in the United States with an emphasis on persistent bio-accumulative compounds (PBTs) such as pesticides, mercury, polychlorinated biphenyls (PCBs) and dioxin. The program is assessment oriented providing a broad spectrum of information on the watershed impacts directly associated with air deposition. Lastly, it is imperative to recognize and foster the important linkages to particulate matter and ozone, especially considering the high relative air toxics risk associated with diesel emissions, and the ongoing benefits to air toxics associated with over two decades of volatile organic compound reductions effected by the ozone program.

Several technical tools that support these programs include emission inventories, air quality modeling, data analysis and monitoring programs. The National Air Toxics Assessment (NATA) provided county level summaries of HAPs exposures based predominantly on modeling and emissions data. The models, inventories and data analysis are the planning and assessment tools that are used directly in support of numerous assessments across the air toxics programs. Monitoring data indirectly and in some case directly support all the technical tools as well as the larger programs. The challenge faced in monitoring is in effectively marrying observations with these program elements.

Monitoring Program goal and objectives. The goal of the air toxics monitoring program is to support reduction of public exposure to HAPs. Monitoring data will provide a critically important role by characterizing HAPs concentrations to support three very basic monitoring objectives, and also several sub-objectives. These objectives are:

1. ***Trends***. Measurements of key HAPs in representative areas of the nation to provide a basic measure of air quality differences across cities and regions, and over time in specific areas. Trends measurements provide one basis for accounting for program progress.

2. ***Exposure assessments***. Ambient measurements may serve as a surrogate for actual human exposure. However, understanding relationships between ambient concentrations and personal exposure and how human activities impact these relationships is critical for true exposure assessments. Therefore, ambient measurements *support* exposure assessments by providing ambient concentration levels for comparison with personal measurements. In addition, ambient measurements may also provide direct input into more detailed human exposure models that can be used to estimate actual human exposures.

3. ***Air quality model evaluation***.[1] Measurements provide basic ground truthing of models which in turn are used for exposure assessments, development of emission control strategies and related assessments of program effectiveness. In addition, measurements provide direct input into source-receptor models which provide relatively direct linkage between emission sources and receptor locations.

Sub-objectives to aid the overall program and also to specifically aid State and local jurisdictions with their issues are as follows:

1. ***Program Accountability.*** Monitoring data provide perhaps the most acceptable measure of air program progress, i.e., observed changes in the atmosphere consistent with expectations of emissions strategies. Accountability is the closest direct match to measurements in addressing agency goals as outlined in the Government Performance and Results Act of 1993 (GPRA), and applies for all programs (MACT,

[1] Generally, model evaluation is a subobjective of a broader objective referred to as emissions strategy development. In the case of HAPS, most emission strategies largely have been developed and are (and have been) undergoing implementation.

residual risk, area sources, mobile source rules, local scale projects).

2. ***Problem identification.*** Measurements are used to uncover a suspected air quality issue associated with a specific source, or source groups, or, confirm that a problem does not exist. Given the numerous HAPs and variation in issues across the nation, this particular objective probably attributed to much of the historical toxics monitoring as well as the emerging local scale projects studies.

3. ***Science support.*** Routine network measurements often provide a backbone of basis measurements from which more extensive research studies can utilize in the areas of model process development, exposure studies and health effects. By themselves, data from the network should provide a basis for a wealth of long term epidemiological studies associating adverse health impacts with observations, particularly where toxics measurements are grouped with multiple pollutants. In addition, given the current limited research efforts on methods development, the national air toxics program can also provide opportunities to test and advance measurement methodologies for air toxics.

Recent Monitoring Program History. Congress appropriated $3M in State and Local and Tribal Grants (STAG) Section 103 funds for air toxics monitoring in 1999. A Steering Committee consisting of representatives from EPA, State and local agencies was created to design the initial monitoring program, and remains as a standing committee to provide continued direction. An air toxics concept paper was produced in 1999 provided very broad program objectives, and received a general favorable review from a Clean Air Science Advisory Committee (CASAC) subcommittee. The initial funding was allocated to a series of pilot monitoring studies and to perform in depth analysis of monitoring results from those studies as well as from a historical data base of toxics monitoring conducted at over 200 locations nationwide. Conceptually, the pilot studies and historical data would provide a rich venue to base subsequent network design decisions upon. Concurrently, findings from the 1996 NATA analyses also impacted initial network design decisions. Based on NATA and some very preliminary data analysis results, the committee initiated a modest National Air Toxics Trend Station Network (NATTS) of 22 sites focusing on priority pollutants as suggested by the NATA findings: [formaldehyde, arsenic, chromium, benzene, 1,3 butadiene, acrolein]. Two other concurrent events also shaped some of the initial design, the development of an overarching National Air Monitoring Strategy (NAMS) and implementation of the nation's $PM_{2.5}$ monitoring network. These activities fostered greater integration with criteria pollutant networks, by stipulating that the NATTS sites would serve as precursors for future National Core (NCore) Level 2 multiple pollutant stations, and by adding continuous light absorbing carbon to the NATTS list, recognizing the large risk air toxics associated with diesel particulate matter.

Having established a trends network focusing on more nationally pervasive pollutants, the steering committee struggled with defining a more localized component of the air toxics network. In addition, a myriad of technical and logistical issues started to emerge. Most of the technical issues were (and still are) attributed to consistency and quality assurance shortcomings observed in the data, as well as methodological gaps constraining our ability to measure key pollutants with a desired frequency. Logistically, issues of resource allocation created challenges related to equipment ownership, allowable use of resources and basic equatability. With only $3M annually, the committee implicitly recognized that very little should be expected beyond a modest national trends network with resources allocated for quality assurance and data analysis. Local air toxics monitoring needs would have to be addressed by $6.5M in STAG 105[2] resources that were shifted from criteria pollutants to air toxics in 2001. In effect, those resources only covered part of the work agencies were conducting prior to the new $3M added in 1999 and provided no real ability to enhance the national program.

Congress appropriated an additional $7M in FY 2004 for air toxics monitoring with the expectation that these funds would provide a solid foundation for the agency to assess progress toward achieving basic GPRA objectives calling for a reduction of public exposure to HAPs. The Steering Committee clearly chose not to add additional NATTS in the interest of avoiding redundant results, implied by various findings that emerged from NATA and other data assessments and, in broad terms, recognized the need to complement the NATTS with more flexible and locally oriented components. Due to various requirements and limited resources, EPA determined that the majority of these new resources would be allotted to "local-scale based monitoring projects" under a competitive grants program. Exploration of allocating these resources through future non competetive venues is underway. The rationale and objectives for these local scale projects and their role in a longer term vision for the air toxics monitoring network is the subject of much of this report.

Major Findings shaping the air toxics monitoring program. Information from NATA, initial results from the Pilot City studies and efforts to analyze the historical air toxics data base had significant impact on the direction the program has taken. Example findings from these efforts included:

- NATA. The NATA results helped prioritize the key NATTS pollutants based on the national risk assessment across 188 HAPS. Consequently, the list of 6 major pollutants provided a focus for the NATTS. NATA results also suggested great variety in the nature of exposures with an emphasis on fairly specific localized components of HAPs exposures, which helped moderate the emphasis on a national trends network toward local scale projects.

- Analysis of historical data. Data collected by numerous agencies over the last decade

[2] Note that Section 105 STAG resources require agencies to match the Federal Grant at nearly a 1 to 1 ratio. In contrast, Section 103 resources do not require matching funds, and generally are intended to support national objectives under an evolving program.

provides a wealth of information that largely confirms much of the NATA findings suggesting the prevalence of mobile source toxics (e.g., benzene and 1,3 butadiene) above health benchmark levels. Ongoing efforts to mine information from these data should yield valuable policy relevant insights over the next 2 years. A review of the data during Phase I of the pilot project yielded important insights such as a large amount of data inconsistency associated with variations in sampling techniques, laboratory protocols, reporting criteria and non-standardized quality assurance practices. These observations motivated the Steering Committee to elevate the need for data consistency and sound quality assurance practices into the program.

- Pilot City Studies. These studies confirmed some of the earlier conclusions from NATA and prevailing judgment by illustrating the variant nature of air toxics both from within and across cities. With the exception of relatively consistent motor vehicle signals, the data showed extreme variation in the relative levels of particular pollutants that largely were influenced by proximity to sources, particularly highways. Clearly, a single NATTS site should rarely be viewed as being representative of the many disparate locations throughout a metropolitan area. Accordingly, a more realistic expectation of the NATTS emerged suggesting that these sites should provide adequate basis for tracking progress of mobile source oriented emission reduction programs at a national level, but provide only a limited perspective on characterizing a city's air quality. Clearly, more focused studies that either address fairly specific source categories or provide greater spatial resolution (i.e., more stations) are needed to complement the NATTS.

Current Air Toxics Monitoring Program Structure. Based on these and other findings, the Steering Committee shaped the air toxics monitoring program along the following lines:

1. ***NATTS***. Approximately 74% of the base $3M section 103 STAG grants support a modest set of 22 national air toxics trends sites (NATTS) that are focused[3] on seven priority pollutants (formaldehyde, arsenic, chromium, benzene, 1,3 butadiene, acrolein, light absorbing carbon). These sites are located at existing $PM_{2.5}$ speciation sites and constitute the beginning of the new NCore Level 2 multiple pollutant network developed under the national monitoring strategy. Although the longevity of trends sites typically extends over a decade or more, the NATTS must be evaluated, and modified as needed, on 6 year intervals to assure continued relevancy.

2. ***"Local" scale monitoring studies***. Local scale monitoring studies complement the NATTS by allowing for flexible approaches to address a wide range of air toxics

[3] In addition to the 7 priority pollutants, several additional useful pollutants also are captured under the NATTS that are included in the analysis protocols.

issues. They are intended to probe potential problem areas throughout the nation that may require subsequent attention with respect to more dedicated moniitoring and aggressive emission mitigation strategies. In some instances these studies will be used to better characterize impacts of diesel emissions, or to define spatial concentration patterns throughout an area that simply is not achievable with a single NATTS site. Local scale monitoring studies are supported by the majority of the $7M additional Section 103 funds added in FY 2004. Currently, there is some uncertainty regarding the long term availability of these funds. A limited number of projects are expected to be funded each year in different locations. Projects will address issues of urban/local interest such as impacts from specific sources (predominately area), spatial variability in air quality, diesel emission impacts, and wood smoke impacts. These projects are expected to last from 6 months to 2 years. In large measure, these studies also will be used in a screening context to help prioritize areas for subsequent monitoring and analysis efforts. Local scale monitoring studies in combination with the NATTS constitute the principal components of the "National" monitoring program. This two- tiered approach will permit refined calculations of exposure and health impacts. To that end, the Standing Air Monitoring Work Group (SAMWG) air toxics working group has requested that EPA ensure that the collection of local studies demonstrate relevance to the entire nation, through a combination of diverse, yet representative, projects spread reasonably through different geographic regions

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3. ***Agency specific monitoring.*** These activities include a variety of air toxics monitoring activities that have been (and still are) performed by agencies prior to the recent Section 103 STAG grants specified for air toxics monitoring. The EPA redirected $6.5M in Section 105 STAG funds from criteria pollutants to air toxics monitoring, partially in recognition of the work already being performed in this area. These efforts truly reflect the most flexible component of the program, with very few restrictions (largely limited to data reporting) imposed by the Steering Committee or EPA Headquarters.

4. ***PBT monitoring.*** Existing monitoring programs that measure Persistent Bioaccumulative Toxics or PBTs (e.g., mercury, dioxin, and PCBs) tend to focus on pollutant deposition by providing either direct measurements or indirect measurements using ambient data. This is because the primary route of exposure for these pollutants is ingestion. The largest of these monitoring programs is the National Atmospheric Deposition Program- Mercury Deposition Network (NADP-MDN), which currently includes approximately 90 sites that measure wet deposition of mercury. The NADP-MDN is a multi-agency program with voluntary participation and it provides the only routinely available data base for mercury wet deposition on a national level. Another program that provides routinely available PBT measurements is the Integrated Atmospheric Deposition Network (IADN). IADN is run by the EPA and the Environment Canada and provides measurements for PBTs in the Great Lakes Region.

The EPA also currently operates the National Dioxin Air Monitoring Network (NDAMN). This program, which currently includes about 30 sites, is designed as a research program, but could easily be extended to routine data collection. The above PBT monitoring efforts, along with other efforts being conducted in specific regions (e.g., New England) or states, provide excellent opportunities for integration with existing or planned air toxics monitoring efforts. Finally, by their nature, PBTs tend to persist in the environment and can travel long distances. As a result, there are also international efforts to improve PBT monitoring that provide opportunities for leveraging and integration.

5. ***Data Analysis.*** The Steering Committee dedicated a major component of the program to data interpretation, beginning with the first year of the program. This component not only has provided insight into an array of issues and helped shape program design, but it also has provided a communications vehicle through a series of workshops dedicated to analysis with immense spinoff benefits in the areas of program communication and coordination, network design and assessment, methods and quality assurance.

6. ***Improved technology and analytical skills.*** The strategy must advance the skill and tools require for meeting current and future national needs. Several priority pollutants have significant measurement issues; cost effective, reliable routine continuous technologies for air toxics are not available; and adequate gaseous phase measurements for mercury, an agency priority, remain in the research realm.

7. ***Quality Assurance.*** A coordinated and assertive quality assurance program with a centralized Federal component to ensure data quality and consistency, necessitated by a plethora of data quality issues that were uncovered in attempting to mine the data collected by at over 200 State and local agency stations.

Local scale monitoring projects. Local scale projects studies represent a very broad group of projects that clearly are delineated from NATTS as they are of short duration (typically less than two years) and are not required to measure NATTS parameters. The intention of these projects is to provide a localized component to the national program, with the flexibility to address issues beyond the scope of the NATTS. Whereas the NATTS are best identified with the trends and accountability objectives,[4] local scale projects are more oriented toward addressing problem identification, and better suited for model evaluation support, assuming the projects offer more detailed spatial coverage than a single NATTS. Since these projects are expected to be of short term, they may be rotated over the years to different locations. Their role in program accountability is largely one of establishing a baseline characterization of a

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[4] There is not a clear demarcation specifically relating network components to objectives. Through the integration of network components most objectives are more comprehensively covered.

local-scale's air quality that is well matched to an associated emissions mitigation approach. Clearly, there is an expectation that following the initial period of these local-scale studies, provisions will be made to either extend a critical subset of monitoring tasks, or revisit an area at a later date to assess the impact of a particular program.

What kinds of local-scale monitoring studies are expected? Admittedly, there is no single clear way to articulate what a local scale project study is, given the decision to avoid redundancy and create a variety of assessments that allow for probing into the myriad of local/urban scale problems. A competitive proposal process will be used in the first year to solicit the best ideas from agencies and Tribes that are well connected to problems that require attention. Against this backdrop, there is an expectation that these projects will address one or more of the following topics:

1. impacts associated with sources by characterizing ambient air toxics signatures from various industrial or commercial sources;

2. evaluating the impact of novel emission mitigation practices or technology changes; such as transportation fleet conversion relying on advanced fuels or new technologies

3. network design issues related to characterizing the site representativeness with respect to spatial variability, maximum pollutant concentrations, and scale of representativeness; for those areas with a NATTS, site representativeness would be evaluated;

4. more resolved spatial resolution of an area's air quality to better estimate exposures and to support model evaluation efforts incorporated in NATA;

5. assessing impacts associated with diesel and/or wood smoke generated HAPs, leveraged with ongoing particulate matter monitoring and assessment efforts; and

6. application of technologies that offer promise for near continuous measurement output.

The EPA, State, Local, and Tribal agencies (S/L/T's) will use these studies to develop a much broader understanding and confirmation of the HAPs issues facing communities across the country. Example questions that may be answered include:

1. What kind of toxics signal is associated with: (a) a major airport; (b) a diesel fuel bus fleet and associated depot; (c) coatings or metal plating operations; (d) refinery or chemical production facilities?

2. What environmental benefits are being derived from a particular local-scale based

mitigation project, or from a larger scale effort (MACT, area source standards) in a community?

3. How reliable are the model predictions underlying the NATA analyses?

4. What areas require subsequent (and at what level and quality) monitoring based on the measurements and the probability of assessing changes associated with an emissions abatement strategy?

5. What are the relative contributions to total HAPs risk associated with diesel emissions, wood smoke, light duty motor vehicles and/or other important source categories?

6. What network design recommendations are appropriate for a particular community/urban area?

7. What are the next steps to be taken in air toxics monitoring (e.g., continued rotation of local scale projects, focus on longer term assessments of priority cities, addition (or deletion) of NATTS, change in measurement parameters).

Obviously there exists a major challenge in synthesizing the information from so many variable studies. Determining the next steps will depend on the outcome of these studies, as well the NATTS and other information sources. It may not be practical to manage a competitive system each year given the broad scope of issues to address and approaches to utilize. Results from these studies may tell us that a far more prescriptive approach (and perhaps unique or unknown at this point) is needed, to address an aggregate of "national" issues. Clearly, the technical advisory committees associated with the monitoring program need to remain vigilant with regard to the value derived from these efforts and continue the attempt to achieve maximum value from monitoring resources.

Integration with other networks. The air toxics network presents an excellent opportunity to leverage existing networks, and foster the development of related new networks. The NAMS has promoted the need to enhance multiple pollutant monitoring in recognition of the scientific linkages across pollutant categories. The NCore monitoring network concept enhances the leveraging of existing networks and adds a minimum of needed pollutant measurements that currently are not conducted on a routine basis. Within the NCore design, approximately 75 NCore Level 2 multiple pollutant sites are to be based at existing PM2.5 speciation sites (some of which also are ozone precursor sites), with the addition of trace level nitrogen, sulfur dioxide, and carbon dioxide gaseous measurements. The 22 NATTS are intended to be part of the NCore Level 2 sites. The NATTS benefit from a well developed infrastructure (monitoring platform, power, operators) and the NCore network is enhanced by having an incredibly rich set of measurements provided through NATTS.

More specific measurement integration between air toxics and particulate matter is fostered through deployment of light absorbing carbon (a possible marker of "diesel PM") through aethalometry in the NATTS. Similar integration, but of greater depth, is expected over time from the local scale project studies which have the flexibility to probe into organic speciation of wood-smoke and diesel emissions. Out of convenience and past practice, we manage programs on a pollutant by pollutant basis. Technically and scientifically, such delineation simply is not supported and there is a risk that such management practices will, in the long term, lead to less effective solutions due to information constraints relative to the very broad scope of air quality management.

There remains very little integration with PBT and related ecosystem welfare programs. This gap is due to a combination of factors mostly related to current organizational priorities. PBT and ecosystem work often is conducted under water and hazardous waste disciplines, as well as through the research community given the technical challenges posed by measurements and multimedia and global transport processes attributed to these pollutants. For now, the national toxics strategy and especially the $10M in Section 103 Grants remains focused on more traditional inhalation pathway exposures of more ubiquitous HAPs. Additional integration steps must be engaged to produce a true integrated approach to air toxics/air quality assessments and management.

Prevailing Technical and Logistical Issues. Unfortunately, the air toxics program is embarking on a data collection regime with very significant measurement issues. These issues include inadequate routine technologies to measure priority HAPs (e.g., acrolein), significant method detection problems (e.g., arsenic), and a virtual lack of continuously operating methods relegating the program to outdated integrated techniques that, due to resource constraints, only capture pollutants every sixth day. Despite these issues, there will be an enormous net benefit derived from the program. While there are significant issues, in most sampling and analysis protocols, a variety of HAPs of very acceptable data quality are produced which support numerous program objectives. The funding evolution for this program is repeating a pattern where adequate resources for application far outstrip resources allocated for technology development and testing. EPA's Office of Research and Development actively participates in the process, but current resource allocations for technical methods, research and development are not in balance with the air toxics monitoring applications program. At a minimum, the national program should include a Supersite dedicated to methods testings and technology transfer to S/L/T's.

The dominating logistical challenge is the administration of a complex monitoring program striving to meet technical objectives, with equitable and ethical resource requirements, in which literally hundreds of agencies and Tribes are eligible participants. For example, early Steering Committee discussions included proposals for rotating mobile equipment from one city to another. The apparently simple issue of equipment ownership emerged as a real obstacle to consider pursuing a mobile approach. The uncertainty in stable funding leading to rotating local scale projects creates tension in agencies that must deal with staffing issues that may require temporary (perhaps unskilled) operators, or require significant compromises in other programs. Monitoring traditionally has had to assume stability and consistency to develop a worthwhile product. The short term, rotating assessments are technically desirable and have great promise, but a careful evaluation of their success must address the overall logistics and associated complications accompanying the program. Synthesizing information from the local-scale projects creates significant challenges, based on the anticipated variety of projects and program objectives.

Program future. The air toxics monitoring program will continue to evolve based on a dynamic feedback of information created from the program, as well as a changing landscape of priorities as directed by scientific findings and/or political agendas. Ideally, the program should evolve toward a much more integrated system that addresses air measurements in a more fully integrated manner, not just within the atmosphere, but through all media along a continuum from local to global spatial scales. Eventually the information in terms of pollutant concentrations should manifest itself as exactly that – concentrations – and not a number associated with a sampler or a model. Technically, this vision is more than reasonable. Certainly there exists adequate computational capacity, as well as the ability to improve the measurement techniques and process formulations.

2. Background

2.1 Importance of Toxics

There currently are 188 HAPs, or air toxics, regulated under the Clean Air Act (CAA) that have been associated with a wide variety of adverse human health and ecological effects, including cancer and other serious health effects. These air toxics are emitted from a variety of sources, including major, area, and mobile sources, resulting in widespread population exposure. While in some cases people are exposed to an individual HAP, more typically people experience exposures to multiple HAPs and from many sources. Exposures of concern result not only from the inhalation of these HAPs, but also, for some HAPs, from multi-pathway exposures to air emissions.

EPA has five long-range strategic goals [see reference 1] which establish the focus for the Agency's work in the years ahead. One of these goals, EPA's Clean Air Goal, states that the air in every American community will be safe and healthy to breathe. In particular, children, the elderly, and people with respiratory ailments will be protected from health risks of breathing polluted air. Reducing air pollution will also protect the environment, resulting in many benefits, such as restoring life in damaged ecosystems and reducing health risks to those whose subsistence depends directly on those ecosystems. The specific air toxics sub-objective under this goal is, by 2010, working with partners, reduce air toxics emissions and implement area-specific approaches to reduce the risk to public health and the environment from toxic air pollutants. In working toward this risk-based goal, EPA will utilize the air toxics monitoring program as one of the important tools to support reduction of public exposure to hazardous air pollutants (HAPs).

2.2 Role of Monitoring in the National Program

The goal of EPA' s Urban Air Toxics Strategy is to reduce public exposure to HAPs. An important part of the strategy is ambient air quality monitoring to both:

1. Understand HAPs air quality issues at a national level, including identifying problem areas, identifying HAPs of primary concern, and establishing a baseline for measuring progress of HAPs mitigation strategies; and

2. Understand HAPs air quality issues at a local level, including identifying ambient gradients, identifying HAPs of concern, characterizing impacts from local sources, and helping to support mitigation strategies.

At the national level, data are needed to help EPA evaluate its long-range strategic goals. In particular, data from a limited number of monitors spread across the country (in mostly urban, but also a few rural areas) will be one of several tools used to measure the effectiveness of the EPA's national mitigation efforts and establish long-term trends in ambient air toxic levels.

Several national programs were put in place in response to the CAA Amendments of 1990. Specifically. source-specific standards and sector-based standards, including Section 112 standards, i.e. MACT, Generally Achievable Control Technology (GACT), residual risk standards, and Section 129 standards. (see Section 6 below.)

Because there are so many air toxics regulated under the CAA, it is necessary to focus on the pollutants expected to cause widespread exposure and risk to the public. Based on the results of EPA's NATA [see reference 2], we can define which HAPs are expected to cause the most widespread risks to the population and select those HAPs to include as part of a national air toxic monitoring network. By maintaining these national sites several years, we can begin to measure the ambient trends for these key pollutants. The measured trends, along with other tools such as inventories and models, can then be examined to assess the effectiveness of reduction programs. Thus, one objective of the national air toxics monitoring program is to establish trends and evaluate the effectiveness of HAP reduction strategies.

At the local level, data are needed because some of the greatest risks from exposures to elevated concentrations of air toxics occur in particular "hot spots." Many times, the HAPs responsible for such elevated risks are emitted from local emission sources, which have the potential to adversely effect the surrounding community. To characterize concentration gradients within communities, a network of several monitoring sites may be needed (ranging from a couple sites in a small community with an isolated high concentration area to a half dozen or more sites in a large community with multiple high concentration areas). The diversity of air toxics problems in each city present no clear single approach to monitoring. Thus, a second objective of the national air toxics monitoring program is to characterize ambient concentrations (and deposition) in local communities. Projects of this nature can also support studies of personal exposure and health effects associated with air toxics. The primary goal of the EPA air toxics program is to be protective of public health, but there remains much uncertainty about the relationships between ambient levels of air toxics, actual human exposures to air toxics, and the resulting health effects from exposure to air toxics. Ambient air toxics monitoring can provide valuable data to be used by exposure and health scientists to reduce these uncertainties. Both the local community and national trend data can provide this data.

In populated areas, well-sited community-oriented locations will be utilized. These locations should follow established siting protocols and may be selected from the current state and local monitoring program locations or should be new sites to fill gaps in the model evaluation data base. This neighborhood-oriented monitoring approach will be analogous to the core network for $PM_{2.5}$. Such monitoring sites should not be located in areas with large concentration gradients, and, as such, should not be very close to large sources. Ideally, the network should place a sufficient number of sites in each area to assess spatial variability in HAP concentrations. This may be accomplished with fixed sites, movable platforms or portable monitors. However, the availability of limited monitoring resources and the need for good geographic coverage will not allow multiple monitors in all areas.

The monitoring network should also be standardized in other ways: the sites must monitor throughout the year and on the same days/ sampling schedule (*e.g.* 24-hr averages every 6th day or other appropriate intervals); use consistent sampling, analytical methods and laboratory procedures; and follow established quality assurance protocols.

It is this initial ambient monitoring data set, along with EPA's NATA modeling and analyses of air quality data, that will be used to provide a sufficient understanding of ambient air toxics concentrations throughout the country.

Finally, it should be noted that mathematical computer models can be valuable planning tools to simulate air toxics concentrations and support risk assessments. To provide confidence in using these models, it is necessary to evaluate their performance by comparing the modeled concentrations against measured concentrations. As initial comparison studies focused on the national-scale modeling effort (Assessment System for Population exposure Nationwide, or ASPEN) [see reference 3], long term model-monitoring comparison efforts may focus on smaller-scale studies (*e.g.*, urban, local, and hot-spot studies) or special monitoring programs (*e.g.*, multimedia concerns). Applicable monitoring data will be used as a "reality check" on model output. These data should represent sufficient geographic and emission source diversity to determine if the entire modeling system (model, emissions, meteorology) provides appropriate estimates of ambient concentrations to assist in assessment of the goals of the air toxics strategy. A broad selection of locations are needed for the model evaluation. These stations must provide good geographic coverage, represent different climatological regimes, and reflect background concentrations in rural areas. Thus, a third objective of the national air toxics monitoring program is to provide data to support and evaluate dispersion and deposition models.

In summary, the primary objectives of the national air toxics monitoring program are to:

* establish trends and evaluate the effectiveness of HAP reduction strategies at the national level;

* characterize ambient concentrations (and deposition) in local communities; and

* provide data to support and evaluate dispersion and deposition models.

2.3 Chronology

2.3.1 National Air Toxics Assessments (NATA)

The 1990 CAA Amendments provides the framework for the air toxics program. The air toxic program is designed to characterize, prioritize and equitably address the serious impacts of HAPs on public health and the environment through a strategic combination of regulatory approaches, voluntary partnerships, ongoing research and assessments, and education and outreach. The NATA is one of these efforts which helps us identify areas of concern, characterize risks, and track our progress toward meeting our overall air toxics program goals. The NATA activities include expansion of air toxics monitoring, improvements and periodic updates to emissions inventories, national- and local-scale modeling of air quality and exposure, continued research on health effects and exposures to both ambient and indoor air, and development and use of improved risk and exposure assessment tools.

As part of our initial NATA activities, EPA has conducted a National Scale Assessment to characterize air toxics risks nationwide. This assessment characterizes potential health risks associated with inhalation exposures to the 32 HAPs identified as priority pollutants in our Integrated Urban Air Toxics Strategy [see reference 4] and diesel particulate matter. Such a broad-scale assessment was necessarily limited in the scope of the risks that it could address quantitatively. It included risks associated with inhalation exposure only; oral or dermal exposures that are potentially important for some substances were not quantified. The initial National-Scale Air Toxics Assessment was also limited by uncertainties inherent in the various types of data and methods that were available. Despite these limitations, the results represent an important step in characterizing air toxics risks nationwide.

The purpose of the national-scale assessment is to gain a better understanding of the air toxics problem. Specifically, the goal of the national-scale assessments is to assist in: (1) identifying air toxics of greatest potential concern in terms of contribution to population risk; (2) characterizing the relative contributions of various types of emission sources to air toxics concentrations and population exposures; (3) setting priorities for collection of additional air toxics data and research to improve estimates of air toxics concentrations and their potential public health impacts; (4) tracking trends in modeled ambient air toxics concentrations over time; and, (5) measuring progress toward meeting goals for inhalation risk reduction from ambient air toxics. The assessment will not be used directly to set regulatory limits or standards.

The initial national-scale assessment is comprised of four major technical components: (1) compiling a national emissions inventory of air toxic and diesel PM for the year 1996 from outdoor sources; (2) estimating 1996 air toxics and diesel PM ambient concentrations; (3) estimating 1996 population exposures; and (4) characterizing potential public health risks.

In the risk characterization, pollutants were grouped into four categories based on the magnitude of the risk or hazard estimates and the number of people potentially affected. Magnitude of risk was expressed by classifying a substance as a "driver" (i.e., contributing a relatively large share of the total) or an "important contributor" (i.e., contributing a smaller but still important share of the total). The number of people affected was expressed by assigning a substance national scope (i.e., with potential impacts to millions of people) or regional scope (i.e., with potential impacts to tens or hundreds of thousands of people). This categorization scheme produced four groupings: (1) national drivers, (2) regional drivers, (3) important national contributors, and (4) important regional contributors. Twenty-three of the 32 pollutants were placed in one of these groups. One pollutant – polycyclic organic matter – was grouped both with regional drivers and important national contributors.

National drivers included acrolein, benzene, carbon tetrachloride, chromium, and formaldehyde. Regional drivers included, arsenic, coke oven emissions, ethylene oxide, hydrazine, manganese, and polycyclic organic matter. Important national contributors were acetaldehyde, 1,3-butadiene, ethylene dibromide, ethylene dichloride, perchloroethylene, and polycyclic organic matter. Important regional contributors were acrylonitrile, cadmium, chloroform, 1,3-dichloropropene, nickel, quinoline, and trichloroethylene.

In addition, EPA believes that diesel exhaust is also one of the air toxics that poses the greatest risks to the public based on its potential carcinogenic effects and other health effects related to diesel exhaust, especially since diesel engine emissions provide a substantial contribution to fine particle emissions. For the nine air toxics not found to be important contributors to inhalation risks on a national or regional scale, this result does not necessarily mean these pollutants are not important. It could indicate that their main impacts may be limited to the local or neighborhood scales at which we expect the national-scale assessment methodology to under-predict individual risks. These pollutants would therefore be better investigated with local-scale data and assessment tools. Based on a limited comparison with ambient monitoring data, it may also be that the initial national-scale assessment underestimated ambient concentrations, and therefore exposures and risks, as appears to be the case with many of the metals.

Mobile sources air toxics showed a strong association with national-scale risks, but the remaining mobile source pollutants appeared to have limited potential for national- or regional-scale risks. Major sources, in contrast, showed a strong association with regional risks rather than national risks. Area sources appeared to produce important risks on both the national and regional scales. Background sources were associated exclusively with nationwide risks, as expected. Because background was assumed to be the same in all tracts, exposure to background pollutants varied only with different human activity.

2.3.1.1 NATA Findings

Following modeling studies conducted in the 1996 emission inventory for toxic air pollutants, a summary of findings was developed [see reference 2]. The main points are listed here:

1. The distribution of emissions and concentrations does not necessarily correlate directly with risk; we will be addressing the risk distribution in the next phase of the assessment.

2. Concentration estimates are a complex function of a number of factors, including emissions density (number of sources in a particular area), meteorology, and source characteristics, rather than just related to total emissions.

3. Both emissions and estimated concentrations of the 32 air toxics available to date are generally higher in urban than in rural areas.

4. Some pollutants are more evenly distributed around the country (e.g., benzene, which is present in gasoline) while others are linked to areas of industrial activity (e.g.,vinyl chloride).

5. There is considerable variability between the national, state and the county level in terms of contributions by source type.

6. Because different types of sources are contributing to emissions in different areas of the country, the highest ambient average concentration of the individual pollutants occurs in different States (i.e., no one State has the highest concentrations of all the pollutants).

7. The background concentration consists of contributions to outdoor concentrations resulting from natural sources, persistence in the environment, and long-range transport. EPA has background estimates for 13 of the 33 air toxics. For 7 of these 13 pollutants (PCBs, ethylene dibromide, carbon tetrachloride, hexachlorobenzene, ethylene

dichloride, chloroform, and mercury), the background dominates the total estimated average concentration.

8. Of the four main source types (area and other, major, onroad, non road), no one type is a main contributor to the estimated concentrations of the 32 pollutants available to date. The results show that, on a national level, about half of the pollutants have "area and other sources" as the dominant contributing source type.

Table 1. 1996 National Ambient Modeled Concentrations for the 6 Risk Drivers [see reference 5]

CAS Number	Pollutant	One in a million cancer (ug/m3)	NonCancer risk based concentration. HQ=1 (ug/m3)
107028	Acrolein		2.00E-02
N/A	Arsenic	2.33E-04	3.00E-02
N/A	Hexavalent Chromium	2.45E-04	2.94E-01
71432	Benzene	1.28E-01	8.00E+01
50000	Formaldehyde	7.69E-02	9.80E+00
106990	1-3 Butadeine	3.33E-02	2.00E+00

2.3.2 Concept Paper

A Concept Paper was developed that covered all development aspects of the national monitoring program [see reference 6]. Utilizing the framework of the NATA program, EPA developed a model for the monitoring program and presented it to the Science Advisory Board (SAB) in March of 2000 for input and recommendation. The Concept Paper discussed objectives of the program and offered examples to achieve those objectives. The SAB endorsed the principles in the Concept Paper, including development of a pilot project that would help establish the data quality objectives for an overall national program [see reference 7].

The following objectives endorsed by the SAB and outlined in the Concept Paper have been followed throughout development of this program. (More detailed discussion can be found in the Concept Paper at the stated reference.)

- Measure pollutants of concern to the air toxics program,
- Use scientifically sound monitoring protocols to ensure nationally consistent data

of high quality,

- Collect a sufficient amount of data to estimate annual average concentrations at each monitoring site,
- Reflect "community-oriented" (i.e. neighborhood scale) monitoring locations.
- Comply with uniform siting guidelines,
- Represent geographic variability in annual average ambient concentrations,
- Build upon existing national and state/local/tribal monitoring programs,
- Develop a strategic air toxics monitoring approach,
- Make use of existing monitoring sites,
- Perform data analysis/data assessment,
- Focus on model evaluation,
- Develop a long term trends network,
- Allow for temporary air toxics monitoring activities,
- Integrate air toxics and other monitoring,
- Utilize standard monitoring methods,
- Enhance the PAMS program for monitoring toxic VOCs,
- Incorporate measurements for other HAPS when possible, and
- Review network periodically.

All of these activities are aimed at providing the best technical information regarding air toxics emissions, ambient concentrations, and health and environmental impacts to support the development of sound policies in the national air toxics strategy.

2.3.3 Steering Committee/SAMWG Subcommittee

The EPA, in partnership with STAPPA/ALAPCO, began development of the air toxics monitoring program with the Concept Paper and establishment of a Steering Committee. The EPA/STAPPA/ALAPCO Steering Committee oversaw the conceptual development of the monitoring program and were instrumental in outlining initial objectives, principles, and management measures. The Committee met an average of once monthly from 1999 through 2002 to provide technical input and review contractor deliverables and annual grant guidance that was created. Over time, the role and responsibility of the Steering Committee changed and it was re-constituted in early 2003 as the Air Toxics Monitoring Subcommittee of the Standing Air Monitoring Working Group (SAMWG). They continue to meet twice yearly and convene at periodic times to provide input. Utilizing their expertise related to state and local priorities as well as validity of certain technical procedures is invaluable to the ongoing program.

2.3.4 Pilot Project and Data Analysis

To support the first year of national air toxics monitoring, EPA made $3 million available to the states in FY2000. The Steering Committee proposed that these funds be used to support the following two major projects:

(1) $2.5 million for a 10-city pilot monitoring study in four major urban areas and six smaller cities (see table below); and

(2) $0.5 million for analysis of existing state and local air toxics monitoring data.

The purpose of the pilot city study was to provide data to support the development of the national air toxics monitoring network. This monitoring study focused on 18 "core" HAPs, which were chosen for their representativeness, risk, and methods availability relative to ease and accuracy of measurement. Monitoring began in January 2001 and was completed by July 2002.

Table 2. List of Pilot Cities

City	**Toxics Monitored**
Providence, RI	Carbonyls, VOC's, and metals (listed below)
Puerto Rico/Barceleneta, PR	Carbonyls, VOC's,
Keeney Knob, WV	Carbonyls, VOC's, and metals
Tampa, FL	Carbonyls, VOC's, and metals
Detroit, MI	Carbonyls, VOC's, and metals
Albuquerque, NM	Carbonyls, VOC's, and metals
Grand Junction, CO	Carbonyls, VOC's, and metals
Cedar Rapids, IA	Carbonyls, VOC's
San Jacinto, CA	Carbonyls, VOC's, and metals
Seattle, WA	Carbonyls, VOC's, and metals

The purpose of the data analysis project was to help answer questions on proper monitor placement in different geographic areas, sampling frequency, and overall national network design protocols. This project was performed in two phases during 2001 and 2002-2003. The first phase of the data analysis project, which was funded with FY2000 money, relied on historical measurements. The historical measurements of toxic air pollution from across the United States had been collected into a database called the Air Toxics Data Archive (ATDA) [see reference 8]. The ATDA contains information on over 900 pollutants monitored at over 2000 locations in nearly every state and territory since 1980. Because some pollutants have been monitored much more frequently and at many more locations than others, the amount of information in the ATDA varies greatly from pollutant to pollutant. The second phase of the data analysis project, which was funded with FY2002 money (see below), relied on the pilot city measurements.

The key results from the data analyses are as follows:

- An examination of trace metal composition by particle size found that PM_{10} and TSP concentrations were strongly related; however, the relationship differs between types of metals. (A similar analysis of the relationship between $PM_{2.5}$ and TSP was not conducted due to the lack of sufficient data.) It should also be noted that of the seven metals examined, all exhibited statistically significant blank contamination.
- Sufficient resources should be provided for quality assurance (e.g., 15% of monitoring budget) and data management/analysis (e.g., 10% of monitoring budget).
- More effort should be made to promote consistency in laboratory methods and analyses.
- Further work is needed to develop continuous, less labor intensive measurement methods for several compounds.
- Sampling for metals should address filter contamination problems.
- Although the common 1-in-6 day sampling schedule is adequate to characterize annual average concentrations, more frequent sampling is needed for compounds which exhibit strong seasonality, such as benzene and formaldehyde.
- A preliminary investigation of source apportionment using data from Detroit indicated a likely diesel component, based on several key species (i.e., manganese, semi-volatile organics, and EC:OC ratios) and activity patterns. GIS tools were also applied in Detroit to identify candidate monitoring sites for diesel impacts. Following up on this finding, more measurements to identify the diesel component are needed in the network.
- Monitor siting to collect trends and local-scale concentrations should favor residential (neighborhood scale) locations.

This last finding, combined with the NATA assessment and the committee's collective understanding of monitoring gaps resulted in the development of guidance for local-scale monitoring assessments. The emphasis on the local scale projects projects recognized the need to move toward more insightful local/urban scale studies and a desire to link formally with a series of emerging local-scale projects programs, a key component of EPA's air toxics strategy. In addition, these local-scale projects can help define what the representative exposure in urban areas is, so we can develop the ability to monitor or model for that exposure. The diversity of air toxics problems associated with localized areas presented no clear single approach to monitoring, and the committee struggled with defining a collective, well defined vision for utilizing resources. The resulting guidance [see reference 9] for local scale assessments is based on a combination of knowledge gleaned from the pilot city studies, the NATA assessment, as well as the committee's collective understanding of monitoring gaps. (Further discussion of the data analysis results are discussed in Section 3.5.)

2.3.5 Other Early Monitoring Activities

2.3.5.1. 2001 Guidance

In February 2001, EPA issued guidance on the allocation of $3 million in FY2001 money to support air toxics monitoring. An equal amount of funds were provided for monitoring projects by state and local agencies in each of the 10 USEPA regions (i.e., $273K each). (Note, the remaining money was set aside for additional sampling in the four urban area pilot cities and other miscellaneous activities.) A summary of the approved monitoring projects is as follows:

Region I: (a) RI – continuation of one of the Providence pilot sites for trends purposes; (b) NH – addition of carbonyl measurements to existing VOC sites and Hg deposition monitoring; (c) MA – data analysis

Region II: (a) NJ - mobile platform for sampling

Region III: (a) Regional network including at least 5 states and 3 local agencies

Region IV: (a) AL – additional resources for planned monitoring project in Mobile; (b) NC – mobile platform for sampling in Charlotte; (c) MS – new monitoring site along Gulf Coast

Region V: (a) Regional network including at least 4 states and 1 local agency

Region VI: (a) AR – new monitoring sites in Little Rock and West Memphis; (b) NM – new monitoring sites in Albuquerque and Santa Fe

Region VII: (a) MO – additional sampling at existing sites in St. Louis; (b) IA – continuation of the Cedar Rapids pilot site for trends purposes; (c) NE – new monitoring site in Lincoln

Region VIII: (a) CO – two new monitoring sites in Denver, Front Range; (b) UT – adding metals and carbonyl sampling to an existing site

Region IX : (a) AZ – data analysis and some new toxics sampling; (b) CA – two new monitoring sites in San Diego, data analysis in South Coast, and audits for San Jacinto; (c) HI – new monitoring site

Region X: (a) SA continuation of two of the Seattle pilot city sites for trends purposes;

(b) OR new monitoring site in Portland.

2.3.5.2. 2002 Guidance

In March 2002, USEPA issued guidance for the allocation of $3 million in FY2002 money to support air toxics monitoring. The guidance called for:

a. $1,920K State/local monitoring
(Note: this consists of $40K each to 46 states plus Washington, D.C. and Puerto Rico. Four states did not apply for the $40K – KS, LA, MT, and WY.)

b. $480K Establishment of the initial trends sites (11 urban, 2 rural)
(Note: this additional funding of $40K per site plus the $40K per state noted above will provide each trends site with a total of $80K. The 2 urban sites in Region I will split the additional $40K.)

c. $480K Data analysis and inter-lab study

d. $120K On-going pilot city work in Seattle, Tampa, and WV

A key priority with this third year of air toxics monitoring was to establish an initial national trends network to address the trends monitoring objective. The NATTS reflect a limited number of locations. (More trends sites were to be added in future years of the program.) The funding priorities were to establish an urban site in each of the 10 EPA regions, and, as resources permit, a few rural sites. A list of candidate sites was prepared after a statistical analysis was done based on existing air toxics data, NATA results, and each site's current infrastructure. For example, a site was required to have existing $PM_{2.5}$-speciation and air toxics monitoring sites. The initial NATTS began monitoring in January 2003. (See Figure 1.) The NATTS will operate with consistent sampling protocols and will provide data for several air toxics compounds, including benzene, formaldehyde, chromium, and acrolein, as well as "black carbon" as an indicator of diesel particulate. To provide additional information, consideration has been given to supplement the NATTS, such as additional measurements to assess diesel particulate and co-located meteorology.

2.3.5.3. 2003 Guidance

In March 2003, EPA issued guidance for the allocation of $3 million in FY2003 money to support air toxics monitoring. (In addition, EPA reprogrammed $6.5M in section 105 money for air toxics monitoring.) The guidance called for:

$1.3 M Continuation of the initial 13-site trends network

\$0.9 M	Establishment of 9 new trends sites (4 urban, 5 rural)
\$0.08M	Purchase and maintenance of aethelometers at the new urban sites
\$0.12M	Completion of the pilot city data analysis work
\$0.25M	New data analyses
\$0.05M	Methods workshop (see below)
\$0.30M	Initial community-scale monitoring study to be conducted in the Cincinnati-Dayton area

The last project in the list above is the community urban study of air toxics concentrations in the Cincinnati-Dayton area. This area was selected to take advantage of existing studies and on-going air toxics monitoring programs. In Cincinnati, the University of Cincinnati and Hamilton County Department of Environmental Services (DOES) are working together on the Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS). This project aims to characterize the contribution of diesel particulate to ambient $PM_{2.5}$ levels. In Dayton, the Regional Air Pollution Control Agency (RAPCA) is engaged in a NATA refinement study, which was initiated to provide greater spatial detail on community exposures to air toxics. Both projects employ a combination of established and innovative toxics monitoring methods.

Researchers in Cincinnati have established three new monitoring locations at varying distances (50, 200, and 400 meters) from an interstate highway to provide information about particle size distribution, elemental composition and VOC profiles. In November 2003 the first of four intensive monitoring sessions was completed at these sites. In addition to ongoing VOC canister and traditional $PM_{2.5}$ sampling, the sites were equipped for a two week period with Harvard Impactors and a DRUM sampler that speciates particulate matter in eight size fractions for 6-hour time intervals. The DRUM samplers were operated by scientists from University of California - Davis. The next two-week monitoring session is scheduled for early February 2004. Results from the three mobile-source oriented sites will be interpreted in the context of the existing network of $PM_{2.5}$ and VOC monitors in Cincinnati.

The NATA refinement study in Dayton consists of a detailed emissions inventory and dispersion modeling of key air toxics. To increase spatial resolution, existing VOC monitoring sites were supplemented with passive sorbent tubes at 8 locations during a monitoring period in November 2003. The tubes will be analyzed for benzene, methylene chloride, PERC, and TCE. The monitoring data will be combined with the results of dispersion modeling to most effectively characterize local-scale exposures to VOCs in Dayton.

2.3.5.4. 2004 Guidance

In August 2003, EPA issued guidance for the allocation of $10 million in FY2004 money to support national air toxics monitoring. (In addition, EPA reprogrammed $6.5M in section 105 money to air toxics monitoring.) The grant guidance identifies five major areas:

$2.2M	Continuation of the 22-site NATTS
$0.87M	Purchase and maintenance of Chrome VI monitors (at each site), continuous formaldehyde monitors (at up to 3 sites), and high sensitivity CO monitors (at up to 5 sites)
$0.385M	NATTS quality assurance
$0.345M	Data analysis projects (to be determined)
$6.2M	Local scale projects monitoring studies

The local-scale monitoring studies represent the next step beyond the NATTS for the national air toxics monitoring network. The available resources (over $6M in FY04) will allow many cities to characterize air toxics concentrations in their communities. EPA will defer to needs of the local communities in conducting these studies. For example, EPA will allow communities to address those pollutants of greatest concern, which may not necessarily be the same as the pollutants required at the NATTS. EPA has requested proposals for this monitoring by March 31, 2004, and is insisting that monitoring on tribal lands be included in the aggregate group of projects.

2.3.5.5 State and Local Agency Monitoring

State and local air pollution control agencies across the country are collecting air toxics monitoring data at over 300 locations for a number of compounds (see maps below). The purposes of this monitoring include to assess trends, characterize air quality levels, investigate source-specific (compliance related) issues, and support risk assessments. As noted above, the ATDA includes much of the historical state and local air toxics monitoring data. Although there are, in some cases, differences in compounds, sampling protocols, and quality procedures between these data and the more recent national data (i.e., pilot city data and NATTS), the state and local data should be used to help address the objectives of the national program.

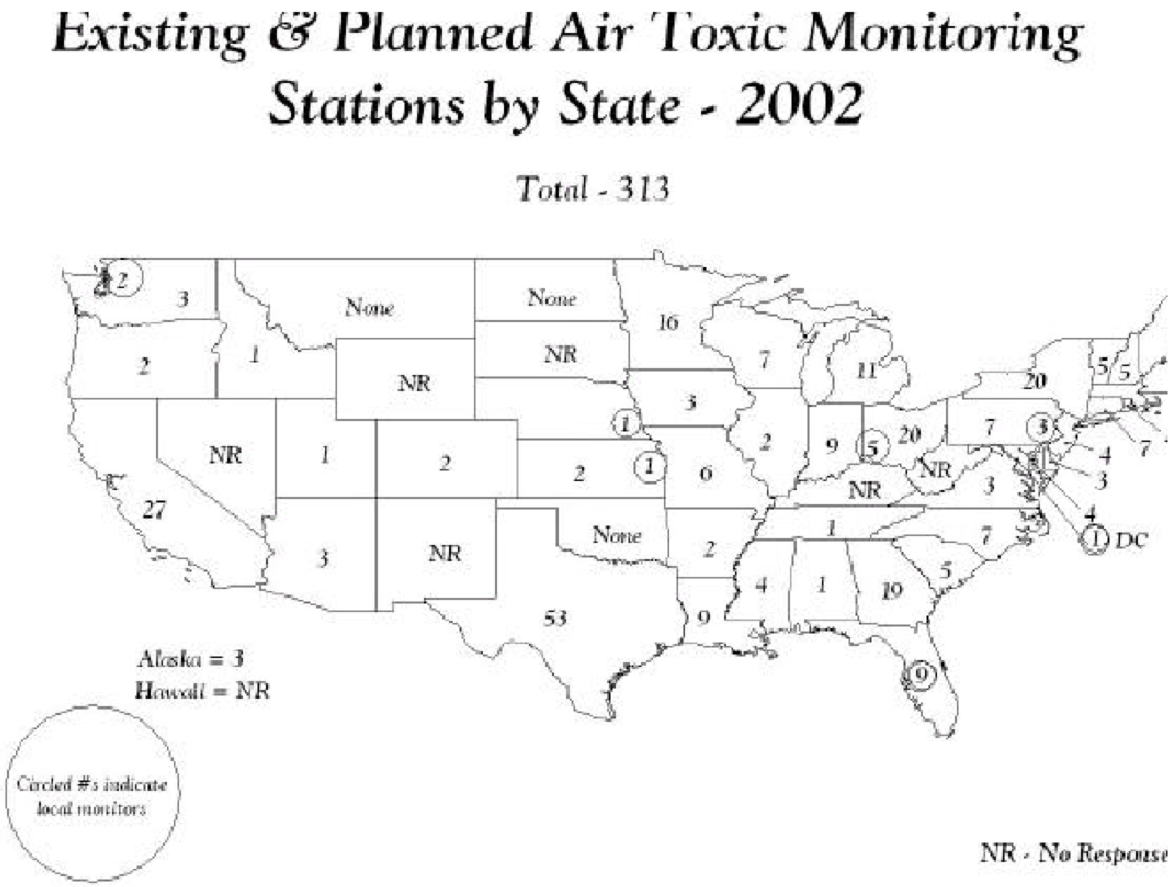

Figure 1. Existing and Planned Air Toxic Monitoring Stations-2002

2.4 Program Summary.

Given this chronological background on the evolution of the network and associated rationale, a summary description of the air toxics monitoring program includes the following elements:

<u>Section 103 Grants</u> (currently $10M)

- Continue the NATTS. These sites are intended to provide a long-term record of priority HAPs across representative areas of the country, and reflect the most prescriptive part of the program to maximize consistency. The NATTS also are catalyzing the new multi-pollutant NCore Level 2 sites that emerged as a key design feature of the national ambient air monitoring program. These 22 NATTS are (and will be) located at existing $PM_{2.5}$ speciation sites, which in some cases are located at PAMS sites. In effect, the NATTS are initiating a national movement towards well-integrated multiple pollutant monitoring systems. The parameter list for the NATTS include priority HAPS associated with mobile sources (benzene, formaldehyde, acetaldehyde, 1,3 butadiene), diesel particulate matter (light absorbing carbon), and metals such as hexavalent chromium and arsenic emitted from a variety of sources.

- Establish local-scale monitoring assessment studies that provide agencies with the ability to address local-scale projects problems and complement the NATTS by providing more detailed spatial coverage in cities, as well as the ability to target pollutants and sources not covered under the NATTS list. As findings from these local scale projects evolve, decisions will need to be made regarding those areas requiring longer-term monitoring based on the level of ambient concentrations and the need to adequately assess the effectiveness of emissions mitigation programs.

- Support a practical and effective quality assurance program that includes local agency and national EPA participation.

- Continue analysis and interpretation of air quality data to address the monitoring objectives.

<u>Section 105 Grants</u> (*currently* $6.5M)

- Address specific local-scale projects problems of concern. State and local agency grantees may use these resources for targeted sources, environmental justice issues, special studies, or to complement the national components covered under the Section 103 Grants.

2.4.1 National Network Design Spacial Scales

The geographic distribution of HAP emissions, and thus concentration gradients, can vary significantly from one location to another, as well as from one pollutant to another. Some pollutants, such as benzene, are typically emitted from multiple locations (i.e, area and mobile sources) resulting in a somewhat homogeneous concentration field. Other HAPs, such as chromium, are typically emitted from point sources, resulting in sharp downwind concentration gradients. Yet other HAPs may be emitted from a combination of point and areas source emissions. In addition, the concentration profiles of HAPs are dependent on various transformation and heterogeneous processes related to relative reactivity and gaseous-particle interactions. Figure 2 shows the concentration gradient for a non-reactive pollutant that is emitted from both a low level stack and a ground level area source. This case provides a very simple illustration to help explain the spatial siting issues discussed throughout this report, and is not intended as a universal example covering all pollutants. In general, the concentration gradient is the steepest within the first few thousand meters downwind from a source. Further downwind the concentration gradient becomes rather flat. The NATTS have been designed to capture the relatively “flat” part of these concentration gradient curves (from approximately 5 kilometers outward). The “local scale” monitoring projects are being designed to capture some of the variability from approximately 500 meters out to 5 or 6 kilometers from a source(s). The national network, as currently designed, is not intended to capture the “steep” concentration gradients within the first few hundred meters from a source. For reference, the “typical” scales utilized in the criteria monitoring program are also included in Figure 2.

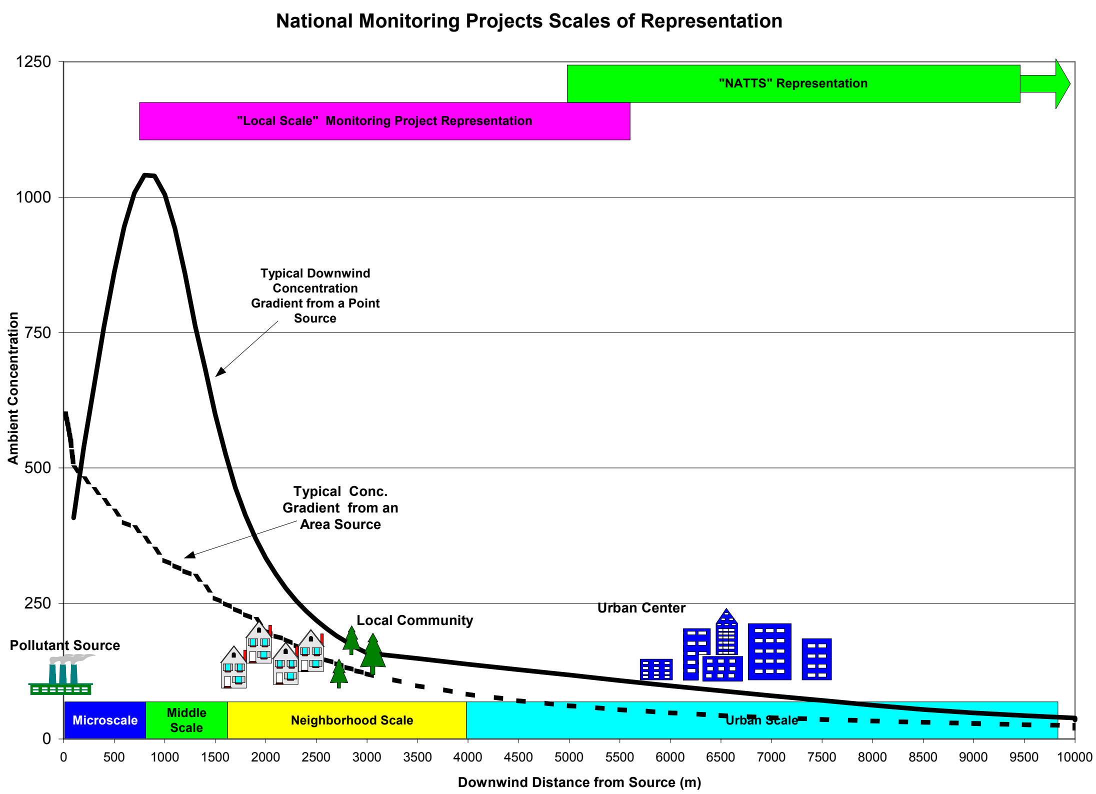

Figure 2. Representative distances for both Local-Scale and Trends-Scale Projects

3. Program Components

3.1 Program objectives and rationale

3.1.1 Historical Recommendations

As noted above, starting with an initial funding base of $3M, EPA along with its State and local partners initiated a pilot monitoring program and supported an intensive data analysis effort of historical and pilot city data to assist in the design of the air toxics monitoring program. The results of those efforts, combined with knowledge gained from the 1996 NATA analyses, led to the following:

1. A limited set of 22 national air toxics trends sites (NATTS) collecting ambient data for a few key HAPs,

2. More extensive local-scale characterizations to complement the NATTS,

3. A data analysis effort to provide information for policy makers, including characterizations of air quality and assessments of control program effectiveness. and

4. A coordinated and assertive quality assurance program with a centralized Federal component to ensure data quality and consistency,

While progress clearly was made on deploying a national trends network EPA recognized two important features inherent in the air toxics program. First, the more nationally pervasive air toxics exposure problems were associated largely with mobile source emissions, resulting in a relatively modest NATTS network. Second, the diversity of potential air toxics problems (e.g., 188 listed HAPs) combined with NATA findings (EPA-453/R-01-003) clearly suggested that attention be given to local-scales to best address a wide spectrum of potential air toxics concerns.

3.1.2 Local-Scale Objectives

Knowledge of a forthcoming additional $7M in FY04 Section 103 money for air toxics monitoring prompted EPA to develop a local/flexible component in its grant guidance to complement the NATTS. The emphasis on the local scale projects recognizes the need to move toward more insightful local/urban scale studies and a desire to link formally with a series of emerging local scale programs, a key component of EPA's air toxics strategy. The resulting guidance for these assessments is based on a combination of knowledge gleaned from the pilot city studies, the NATA assessment, as well as the committee's collective understanding of monitoring gaps. Recent results from the pilot city studies clearly showed the existence of spatial gradients that are not characterized by a single NATTS site, and significant variations in pollutant concentrations across cities. Based on the pilot data analysis results, the data analysis contractor recommended an approach that would establish assessment studies of 1 or 2 years duration in 10 or more cities per year, with rotation to other cities over time to characterize a wide spectrum of communities across the nation. Such studies would attempt to characterize various concentrations within cities by, for example, placing 4 or 5 sites representing the neighborhood, industrial, mobile, and commercial or special industry contributions - such as an airport or large facility.

The SAMWG Subcommittee expressed several concerns with this recommendation, such as the lack of specific monitoring objectives and the implications for equipment and project continuation after expiration of grant resources. The SAMWG Subcommittee also recognized the need to address diesel particulate matter, support the evaluation of air quality models, and link effectively with ongoing and planned air toxics emission strategies (e.g., residual risk, MACT, mobile source rules, and local scale projects), provide continuous measurement methods, and improve measurement methods for important pollutants of concern such as acrolein and arsenic.

Subsequently, EPA recommended in its FY04 grant guidance that the additional $7M in FY2004 money be used to complement the NATTS by enabling agencies to collect more spatially resolved data to better understand urban pollutant gradients, and remove the restriction for adhering to a strict set of measured NATTS parameters so that focus can be directed to those pollutants of greatest concern to local areas. The primary objective of this monitoring is to characterize ambient concentrations in local communities, with the following specific sub-objectives:

1. Producing baseline air quality characterizations that can be tested in the future to measure progress of the emission mitigation strategies,

2. Provide air quality screenings to identify (and to set priorities) areas of concern requiring subsequent monitoring and, therefore, optimize prospective monitoring resources,

3. Supporting the evaluation of air quality models that in turn are utilized to produce risk assessment and exposure analyses for communities, and

4. Accommodating technologies that will advance our ability to characterize and manage air toxics.

The local-scale assessment participants are encouraged to leverage other programs recognizing the efficiencies gleaned from taking an integrated approach in addressing air toxics, PM, and ozone. Examples of such program linkage include toxicity associated with diesel particulate matter and wood smoke, and various volatile organic compounds that simultaneously act as ozone precursors and HAPs.

It is unclear whether an additional $7M will be available in subsequent years. If so, then the results of the initial community study in Cincinnati-Dayton (to be conducted in 2004) and the local scale studies to be conducted in 2005 (with the FY04 money) will be used to help guide these types of studies in the future. As with the 2005 studies, EPA will defer to the needs of the respective communities who apply for the funding.

3.1.3 National-scale Objectives.

Monitoring data will provide a critically important role by characterizing HAPs concentrations to support three very basic monitoring objectives, and also several sub-objectives. These objectives (also listed in the extended summary) are:

1. ***Trends***. Measurements of key hazardous air pollutants (HAPs) in representative areas of the nation to provide a basic measure of air quality differences across cities and regions, and over time in specific areas. Trends measurements provide one basis for accounting for program progress.

2. ***Exposure assessments***. Ambient measurements may serve as a surrogate for actual human exposure. However, understanding relationships between ambient concentrations and personal exposure and how human activities impact these relationships is critical for true exposure assessments. Therefore, ambient measurements *support* exposure assessments by providing ambient concentration levels for comparison with personal measurements. In addition, ambient measurements may also provide direct input into more detailed human exposure models that can be used to estimate actual human exposures.

3. ***Air quality model evaluation***. Measurements provide basic ground truthing of models which in turn are used for exposure assessments, development of emission control strategies and related assessments of program effectiveness. In addition, measurements provide direct input into source-receptor models which provide relatively direct linkage between emission sources and receptor locations.

Sub-objectives to aid the overall program and also to specifically aid state and local jurisdictions with their issues are as follows:

1. ***Program Accountability.*** Monitoring data provide perhaps the most acceptable measure of air program progress, i.e., observed changes in the atmosphere consistent with expectations of emissions strategies. Accountability is the closest direct match to measurements in addressing agency goals as outlined in the Government Performance and Results Act of 1993 (GPRA), and applies for all programs (MACT, residual risk, area sources, mobile source rules, local scale projects).

2. ***Problem identification.*** Measurements are used to uncover a suspected air quality issue associated with a specific source, or source groups, or, confirm that a problem does not exist. Given the numerous HAPs and variation in issues across the nation, this particular objective probably attributed to much of the historical toxics monitoring as well as the emerging local scale projects studies.

3. ***Science support.*** Routine network measurements often provide a backbone of basis measurements from which more extensive research studies can utilize in the areas of model process development, exposure studies and health effects. By themselves, data from the network should provide a basis for a wealth of long term epidemiological studies associating adverse health impacts with observations, particularly where toxics measurements are grouped with multiple pollutants. In addition, given the current limited research efforts on methods development, the national air toxics program can also provide opportunities to test and advance measurement methodologies for air toxics.

3.1.4 Tribal Monitoring

Tribal land monitoring continues to increase in the number of tribes that operate monitors and the number of parameters that are measured. As of August 2002, approximately 50 sites exist for which some data are report to EPA's AQS. Included in this number of 6 ozone monitoring sites; 24 PM_{10} and $PM_{2.5}$ fine mass sites; 2 $PM_{2.5}$ chemical speciation sites. The sites also include a large number of accompanying meteorological measurements and several monitor for VOC and/or toxic chemicals. There are 2 existing IMPROVE [see reference 10] fine mass speciation sites for regional haze measurements and 11 more sites should be added within the next year. With the advent of the local-scale projects in the air toxics program, it is hoped that the air toxics component of tribal monitoring will be enhanced. And as tribal environmental programs build, questions on concentrations, exposure, and reduction strategies are being addressed.

3.2 NATTS

The NATTS includes long-term sited monitoring stations. Currently, the network consists of 23 sites covering 22 cities. (Tampa is participating with a monitoring site in two counties.) These sites have the following characteristics:

- neighborhood-oriented and reflective of general population exposure;
- comply with established physical siting protocols;
- provide good geographic coverage and represent different climatological regimes;
- include appropriate numbers of sites with influences by specific emission sources (mobile and stationary);
- represent regional background and transport concentrations (rural areas);
- include common sets of HAPs at sufficient numbers of sites;
- monitor throughout the year and on the same days/ sampling schedule ; (*e.g*. 24-hr averages every 6^{th} day);
- ensure sufficient data capture; and

- use consistent sampling, analytical methods, laboratory procedures and quality assurance protocols.

3.2.1 NATTS Network Sites

The NATTS network sites are listed in Table 3 and Figure 3. Some of these sites were original pilot cities, such as Providence, Detroit, Tampa, Seattle, and Grand Junction. It is expected that all sites will be fully operational by January/February 2004. The trends sites will be evaluated regularly to assess their effectiveness in characterizing trends and assessing concentration levels. If a given site is determined to no longer be useful for trends (or other) purposes, then it may be discontinued or relocated.

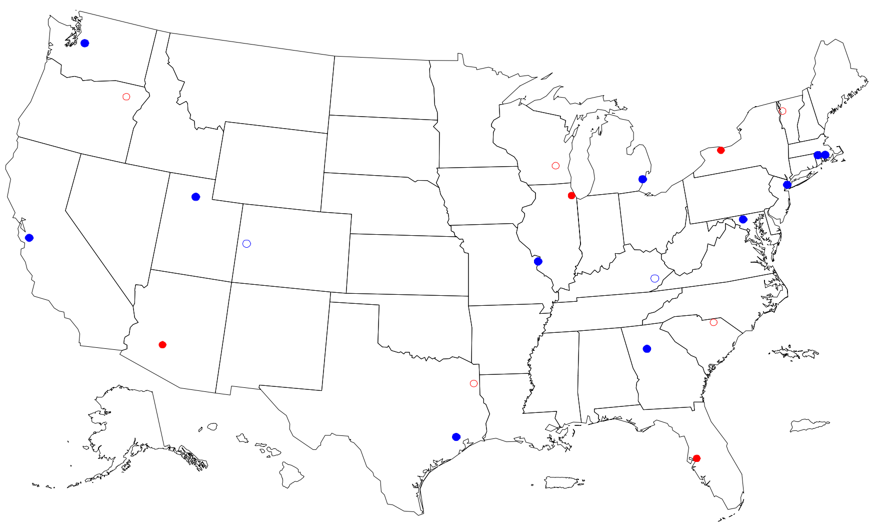

Figure 3. Map of 22 Trends Sites (Blue = urban, Red = rural)

Table 3. List of NATTS Sites

Region	Urban	Rural
I	Providence RI	Chittenden, VT
	Roxbury MA	
II	New York City, NY Rochester, NY	
III	Washington DC	
IV	Atlanta GA Tampa FL	Hazard County, KY Chesterfield, SC
V	Detroit MI Northbrook IL	Mayville WI
VI	Houston TX	Harrison County, TX
VII	St. Louis MO	
VIII	Bountiful UT	Grand Junction CO
IX	San Jose Ca Phoenix, AZ	
X	Seattle WA	La Grande OR

3.2.2 HAPS Measured

A key component for the air toxics monitoring network is the list of HAPs to be measured. Because of the large number and variety of the 188 HAPs specified in the CAA, it is not practical or feasible to measure all 188 HAPs at all locations. It was decided to begin by evaluating the same list of 33 Urban HAPS that were used in the Pilot Project. This list was developed to reflect a variety of possible exposure periods (acute/chronic), pathways (inhalation, dermal, ingestion), and types of adverse health effect (cancer/noncancer). Note, the primary focus of the air toxics monitoring network is ambient air quality and not dermal or ingestion routes of exposure.) Also, due to limitations in available methods, which tend to be 1 in 6 day 24-hour integrated methods, the data from the air toxics monitoring network will more likely support chronic exposure assessments than acute assessments. These HAPs can be grouped into several general categories , which include volatile organic compounds (VOCs), metals, aldehydes, and semi-volatile organic compounds (SVOCs). Black carbon was also added to the list and will be monitored using aethalometer instruments.

Table 4. List of 33 Urban Air Toxics HAPs

VOCs	Metals (Inorganic Compounds)	Aldehydes (Carbonyl Compounds)	SVOCs and other HAPs
acrylonitrile	arsenic compounds	acetaldehyde	2,3,7,8-tetrachlorodibenzo-p-dioxin (& congeners & TCDF congeners)
benzene	beryllium and compounds	formaldehyde	coke oven emissions
1,3-butadiene	cadmium compounds	acrolein	hexachlorobenzene
carbon tetrachloride	chromium compounds		hydrazine
chloroform	lead compounds		polycyclic organic matter (POM)
1,2 -dibromoethane (ethylene dibromide)	manganese compounds		polychlorinated biphenyls (PCBs)
1,3-dichloropropene	mercury compounds		quinoline
1,2-dichloropropene (propylene dichloride)	nickel compounds		
ethylene dichloride (1,2-dichlorethane)			
ethylene oxide			
methylene chloride (dichloromethane)			
1,1,2,2,-Tetrachloroethane			
tetrachloroethylene (perchloroethylene)			
trichloroethylene			
vinyl chloride			

Initial monitoring efforts focused on a subset of the 33 UATS HAPS. The availability and cost of measurement methods, along with the known problems that existed with some of the methods prevented the measurements of all the 33 HAPS listed above. Based on the discussions of a technical sub-work group that was involved in the sampling and analysis of air toxic compounds, the “core” target list was reduced from 33 to 18 HAPs (Table 5.)

Table 5. Core 18 HAPS

VOC's	Metals	Carbonyls
1,3-butadiene carbon tetrachloride chloroform 1,2-dichloropropene methylene chloride tetrachloroethylene trichloroethylene vinyl chloride benzene	arsenic beryllium cadmium chromium* lead manganese nickel	Acrolein Formaldehyde Acetaldehyde

*Replaced with hexavalent chromium beginning in January 2005.

Analysis of the pilot city monitoring data showed that many of the 18 HAPs were not detected in ambient air. In addition, hexavalent chromium rather than total chromium was determined to be of interest from a risk standpoint and, therefore, replaced total chromium on the core list. Six HAPs were, thus, found to be especially crucial in the program based on NATA modeling estimates: benzene , acrolein, formaldehyde, 1-3 butadiene, arsenic, and hexavalent chromium. In addition, through other studies apart from the air toxics pilot, measurement of black carbon has been added to ascertain its viability as a diesel surrogate, primarily at the urban NATTS sites.

The NATTS sites will continue to monitor for the 18 core HAPs above, with a special focus on the six priority HAPs discussed above, and will also report their data quarterly into the EPA Air Quality System (AQS.)

3.3 Local scale projects

As part of the Urban Air Toxics Strategy, EPA is working with states, local communities and tribes to better characterize air toxics problems at the local level and to address those problems through local actions which complement regulatory requirements. The results of the NATA and our monitoring data have shown that despite progress of national efforts, people in many communities continue to be exposed to cancer and other health risks from air toxics. There are currently over 30 community-based projects that are working towards assessing and achieving significant reductions in air toxics from mobile, stationary and indoor air sources, often more quickly than could be accomplished through regulatory means. Monitoring continues to be a significant portion of assessing the problem, informing us on what the air toxic problem may be at the local level and measuring what reductions may have been achieved through actions taken.

The initial 2005 local scale projects are intended to characterize air quality in a handful of cities. EPA intends to defer to the needs of the local communities. Each community seeking grant funds is expected to design and implement an appropriate ambient monitoring program to address its particular air toxics needs. In its FY04 grant guidance, EPA suggested that cities should have several (e.g., at least four or five) monitors representing a variety of land use types, including neighborhood-scale (population-oriented) locations, industrial source-oriented, such as a large facility or airport (exposure-based, not fence line sampling), mobile source-oriented, and commercial source-oriented. The concept behind monitor siting is to ensure sufficient resolution to capture representative concentrations (for each land use type) and characterize spatial gradients over the urban area. Leveraging existing state or local air toxics monitoring projects to obtain the maximum amount of data should also be pursued.

These studies are intended to complement the NATTS by providing the flexibility to address issues that are not ubiquitous at a national level and to provide additional spatial resolution beyond a NATTS. Ideally, the aggregate of the 2005 projects should provide some prototypical examples that can be relied upon without duplication in other areas. Examples might be a single airport analysis, characterization of wood smoke, or evaluation of an industrial park that allows for either direct translation of results to other locations or provides directions for similar studies in areas experiencing common problems. Possible monitoring sub-objectives include:

- Develop a baseline reference frame of air quality concentrations that provide the basis for the longer term measuring of progress of a planned emissions strategy program. This baseline can tie into providing information on what the local air toxics problems may be and the direction needed for national policy development for reducing emissions from particular sources as needed.

- Characterize spatial differences in pollutant concentrations that are driven by factors such as proximity to major roadways, influence associated with important stationary sources and other factors unique to particular communities.

- Characterize pollutants that are not ubiquitous everywhere (e.g., mobile source BTEX compounds), yet remain a problem on a national scale. This might include characterization of wood smoke problems that occur in many regions of the country (for example, in the Northwest, upper Midwest, and Northeast. It does not include, however, compliance issues pertaining to a local plant operation that are unique to a single area.

- Evaluate air quality models that are used for exposure assessments. Air quality models require supporting observations to instill confidence in model results, or to direct needed improvement in underlying model formulations or related emission inventories.

- Test the application of available advanced technologies that can be operated on a routine basis.

As noted above, it is unclear whether sufficient funding will be available in future years to support additional local scale projects. If so, then the results of the Cincinnati-Dayton community study and the 2005 localized studies will be used to help guide additional studies. As with the 2005 studies, EPA will defer to the state and local agency needs.

3.4 Specifications for the NATTS and Local-Scale Projects

The following table outlines all procedures that must be followed by state and local agencies in their respective projects. These specifications are intended to satisfy the technical objectives of generating consistent measurements that are conducive to trends comparisons.

Table 6. National Network Program Protocols

Parameter	Date Due	Comments
Quality Assurance Plan	Due to Regions before monitoring begins	
Measured target pollutants: benzene carbon tetrachloride chloroform 1,3-butadiene 1,2-dichloropropene methylene chloride tetrachloroethylene: trichloroethylene vinyl chloride arsenic and compounds beryllium and compounds cadmium and compounds hexavalent chromium lead and compounds manganese and compounds nickel and compounds acetaldehyde formaldehyde acrolein Black carbon	All data to be reported to AQS quarterly – January, April, July, October - for previous quarters, 90 days after the end of each quarter.	NOTE- comprehensive QA is required for the six following compounds: Hexavalent chromium Benzene Formaldehyde Acrolein* Arsenic 1,3-Butadiene Local-scale projects can omit and/or include other pollutants as is appropriate for their study, with the exception of mercury.**
Methods IO-3, TO-15, and TO-11A, Aethalometry and California Method for Hexavalent Chromium		These are available on AMTIC: http://www.epa.gov/ttn/amtic Aethalometry discussion (12), hexavalent chromium method (9)
QA budget not less than 10% of total expenditures.		
Co-location not less than 10% of sampling.		Co-location sampling can be from monitors in close proximity to a site – please give details in grant application.
PM10 federal reference method to be followed	Please reference EPA QA handbook Volume II Section 2. 11 for operation and procurement: http://www.epa.gov/ttn/amtic/files/ambient/qaqc/2-11meth.pdf	
Each site encouraged to follow Technical Assistance Document (TAD) for NATTS	TAD will be final late winter 2003, however draft will be available at: http://www.epa.gov/ttn/amtic/files/ambient/airtox/nattsdraf.pdf	
A 2002, 2005, and 2008 emission inventory due in conjunction with the National Toxics Inventory (NTI) Emission Inventory due dates.	A complete required for each study area. Refer to the Emission Inventory Regional Representative for guidance, "complete area" definitions, and NTI due dates.	

*Laboratory methods for acrolein measurement are currently being revised. Grantees are encouraged to work with their laboratories on using alternative methods when measuring this chemical, or may elect to forego this measurement until EPA has formalized an appropriate method (target date FY 2005.)

**Mercury measurements would take a disproportionate amount of funding from other aspects of the national monitoring program due to their extreme expense. Thus, they will not be funded under this grant program.

3.5 Data Analyses

During the first three years of national air toxics monitoring, the Lake Michigan Air Directors Consortium (LADCO) under a grant from EPA directed the completion of the first two phases of the project to analyze ambient air toxics data. For these efforts, LADCO contracted with Battelle Memorial Institute and Sonoma Technology.

Completed in October 2001, the first phase focused on 'mining' existing ambient monitoring data to provide information on spatial and temporal patterns and the general characteristics of air toxics. Much of this work focused on assessing the monitoring data included in the ATDA. Designed to augment the first phase and provide monitoring network design recommendations, the second phase of the data analysis project was completed in July 2003 and concentrated on the analysis of the data from the pilot city monitoring study. Reports on the first and second phase results are available on the LADCO website [see reference 11].

In addition to the detailed, technical findings regarding sampling and analysis methods, and spatial and temporal variability, the national data analysis project provided the following recommendations concerning the design of the national monitoring network:

- A nationally-consistent monitoring network is needed with common sampling and analysis procedures, a common set of compounds, and common quality assurance and data reporting.

- The national network must address the following monitoring objectives:
  - assess trends;
  - characterize local-scale concentrations; and
  - support air quality modeling.

- The 22 site NATTS network will provide data sufficient to address the first objective.

- Other measurements to supplement the NATTS include additional diesel particulate measures (e.g., continuous organic/elemental carbon), wet and dry mercury deposition, dioxin and collocated surface meteorological data. *(Unfortunately, the mercury and dioxin recommendation can not be funded under this program due to the large expense.)*

- To address the other two monitoring objectives, more local scale monitoring is needed similar to that conducted in the pilot city study for the major urban areas.

At the time of this document's publication, the national data analysis project had just started its third phase. This phase will focus to a greater degree on answering relevant policy and program questions than did the earlier assessment phases. Questions initially serving to direct this next phase include:

* How good are the data (i.e., data quality)?

* What are air toxics concentration levels from a broad national and local urban perspective?

* What do ambient data say about the effect of various control programs in reducing air toxics concentrations?

During this next phase of the national data analysis project and beyond, broad national level analyses will also be supplemented with assessments of local-scale issues to improve the general characterization of air toxics concentrations. Significant effort will be expended to investigate spatial gradients in ambient toxic concentrations and the effectiveness of various control programs using the data from the ATDA, the Pilot City Study, the NATTS, and localized projects, in conjunction with that from the NATA.

Assessments of spatial variability will seek to address questions such as those listed below:

* What does a national assessment say about air toxics concentrations across the country?
* How do levels of air toxics vary across an urban area? Across a rural area?
* How do urban toxics concentrations compare to those of nearby rural areas?
* How do toxics concentrations compare from one urban area to the other?
* Is there a "typical" urban profile(s) for air toxics? "Typical" rural profiles?
* What are the relationships between distinct urban and rural profiles to demographic, economic, etc. data in the same areas?
* How can levels determined from a limited national network be used to extrapolate to other areas (i.e., areas currently without toxics monitors)?

Assessments of control program effectiveness will seek to address questions such as those listed below:

* How effective have maximum achievable control technology (MACT) standards been in reducing ambient toxic concentrations?
* How effective have the recent local-scale projects been in reducing ambient toxic concentrations?
* How effective have mobile source controls been in reducing ambient toxic concentrations?
* To what degree have ozone and particulate matter control programs reduced ambient toxics levels?
* Can ambient air toxics data be used to help set and measure GPRA goals?
* What is the residual ambient concentration (i.e., what is left over from other major toxics mitigation strategies)?
* What are reasonable estimates of background levels for air toxics?

In addition, ambient air quality data for toxics will continue to be used in the support and evaluation of dispersion and deposition models. Work to evaluate the most recent NATA modeling results for 1999 will continue as will the exploration of improvements to the evaluation methodology. Ambient air quality data from two Pilot City Study locations (i.e., Detroit and Seattle) are scheduled to be used to evaluate the results of one or more air quality models to complement on-going NATA model evaluations. Using ambient air quality data to evaluate modeling results, some specific areas of investigation may include:

* Examination of the usefulness of ASPEN modeling for impact assessment and planning to support the air toxics program
* Impact of emission inventory quality on predicted concentrations (i.e., to what degree are inventory quality, model formulation or meteorological inputs limiting model performance?)
* Effect of complex meteorology and terrain on predicted concentrations
* Evaluation of model performance in replicating local and regional variability in concentrations

Finally, work will continue on the establishment of a single, definitive repository of ambient air quality data on toxics that includes the ATDA as well as pilot city study and NATTS, IMPROVE, CASNET, speciated $PM_{2.5}$ and PAMS data. This effort will build on the prototype ambient air toxics web site developed by the Cooperative Institute for Research in the Atmosphere (CIRA) under contract to EPA. The objective of this work is to assemble a easily accessible, comprehensive data base with metadata that indicates the quality of the available data according to analytic use. In addition, the data system will either deliver valid data summaries or provide instruction to the user in how to construct such summaries, and will provide some data analysis capabilities. Such a system will reduce the initial data manipulation burden to individual users and help improve the consistency of analyses across users.

4. Technical Issues

4.1 Methods and Consistency

There are a number of technical issues surrounding the methods used for the National program. A Technical Assistance Document (TAD) has been drafted to provide methods guidance and help address consistency issues among the participants in the program [see reference 13].

In order to provide monitoring agencies with flexibility in how the methods used for the NATTS are actually implemented, we have embraced the concept of performance based measurement systems (PBMS). For the NATTS, data quality indicators (DQIs) that specify the exact bias, precision and level of sensitivity or detection limits needed will be specified for each of the six key HAPs. If a monitoring agency desires to modify one or more of the key HAP methods that are suggested for use in the NATTS, they will be required to demonstrate applicability of the modified method. The method must provide data that meets or exceeds the specified DQIs. See Section 4.2 for a more detailed discussion on DQIs.

To address some of the method issues with metals and aldehydes, a methods workshop was held in October 2003 to help ascertain a level of agreement among the air toxics monitoring community on how the issues should be resolved. As a result of this workshop, the methods for metals sampling and analysis are currently being reviewed. A decision to switch from using a high-volume PM_{10} sampler with an 8 x 10 inch quartz filter to a low-volume PM_{10} sampler with a 46.2 mm Teflon filter is currently being evaluated. *(A final decision on this should be made by January 2004)*. For information on other issues that were discussed at this workshop, refer to the information web site that was developed by the Northeast States for Coordinated Air Use Management (NESCAUM) [see reference 14].

4.1.1 Workgroup Efforts

Currently there are two workgroups that meet bi-monthly. These are the NATTS QA workgroup, and the methods workgroup (recently formed after the October workshop.) As recommendations are made for the overall network, the NATTS monitoring community will be afforded the opportunity to comment and provide input.

4.1.2 NATTS Methods

The following is a general description of the methods recommended for use in the NATTS. For detailed description of each method, refer to the TAD and the Toxic Organic (TO) and Inorganic compendium (IO) methods [see reference 15] as well as the CARB SOP for hexavalent chromium [see reference 16].

Volatile Organic Compounds (VOCs). The VOCs are to be measured using Compendium Method TO-15, "Determination of Volatile Organic Compounds in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry, GC/MS". The method includes the use of specially treated stainless steel canisters for sample collection and analysis by GC/MS.

Carbonyl Compounds. The carbonyl compounds (except acrolein) are to be measured using Compendium Method TO-11A, "Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge followed by High Performance Liquid Chromatography, HPLC:" Acrolein is known to have stability issues when collected and analyzed using this method. The EPA's Office of Research and Development (ORD) is currently evaluating a dansylhydrazine-coated sorbent cartridge for sample collection and HPLC analysis with fluorescence detection as a possible method for acrolein and the other carbonyl compounds [see reference 17].

PM_{10} Metals. High-volume PM_{10} samples are to be analyzed with Inorganic Compendium Method IO-3-5, "Determination of Metals in Ambient Particulate Matter Using Inductively Coupled Plasma/Mass Spectrometry, ICP/MS". The use of a high-volume sample collection method is currently being reconsidered due to issues with chromium contamination on quartz and glass fiber filters. If low-volume sampling with Teflon filters is agreed upon for use, the impact that decision will have on the sample analysis procedures will need to be clarified and addressed. As mentioned previously, a work group is currently evaluating and deciding on proposals to address this issue.

Hexavalent Chromium. The California Air Resources Board (CARB) SOP 039 [see reference 16] has been adapted for measuring hexavalent chromium. This method uses sodium bicarbonate impregnated cellulose fiber filters for sample collection with ion chromatographic (IC) analysis. Very limited hexavalent chromium monitoring has been done in the NATTS so far. Results have shown that much of the data were below the method detection limits. Since hexavalent chromium is one of the top six pollutants in the NATTS, method sensitivity needs improvement and more monitoring sites are needed to better characterize the presence of hexavalent chromium and any method issues.

All 22 sites (both urban and rural) will be measuring for hexavalent chromium by January 2005. Collection of the data generated will give us important information about the prevalence of this pollutant, and will further help validate our current models.

Black Carbon. Aerosol Black Carbon is a primary emission from combustion sources. It can be found in diesel exhaust, but it is also emitted from all incomplete combustion sources together with other species such as toxic and carcinogenic organic compounds. Black carbon is ubiquitous and absorbs light. BC will be measured using the Aethalometer™, which is a semi-continuous instrument that measures BC using a continuous filtration and optical transmission technique.

The SAMWG Subcommittee recommended the use of Aethalometers at every urban site in the NATTS. These instruments have been added to the network to measure black carbon. They will be in full operation at all of the urban NATTS sites (total of 15 sites) by January 2004. The intent of using this instrument is to develop a surrogate for diesel emissions. Technical guidance can be found in the TAD. Additional technical information on this instrument can be found through referring to George Allen's (NESCAUM) comprehensive presentation at the October air toxics workshop [see reference 18].

Continuous Formaldehyde. In addition to being a key HAP, formaldehyde is important in the photochemical and oxidation mechanism for the formation of ozone. These atmospheric mechanisms have linkages to VOCs that are also HAPs (benzene, toluene, xylene, etc.). By formulating a better understanding of these mechanisms through modeling, the fate and transport of HAP VOCs may also be better explained. Continuous, high resolution formaldehyde data are needed for NATTS to evaluate models and improve spacial analyses. Continuous formaldehyde monitors are typically based on the principles of the Hantzsch reaction [see reference 19]. This is a wet chemical technique that may pose some issues with field operations. Monitors of this type typically provide 10 or 15 minute measurements of formaldehyde. In order to demonstrate the use of continuous formaldehyde monitors at routine monitoring sites, 3 NATTS will implement continuous formaldehyde in FY 2004.

Trace Level Carbon Monoxide (CO). Trace level CO monitoring devices will be included at four NATTS sites in FY04. CO monitoring is being added to the network to provide continuous, high resolution measurements of CO as a surrogate for other mobile source related combustion products such as benzene and 1,3-butadiene. Continuous CO monitors will be collocated with VOC measurements to explore the correlations and relationships across seasons and locations. CO measurements are not being used as a replacement for VOC measurements, but as an enhancement. Continuous, trace level CO measurements are made using gas filter correlation (GFC) and non-dispersive infrared (NDIR) detection. Although commercial CO monitors were designed to meet the performance specifications required for NAAQS, several instruments have the potential for much greater sensitivity as needed for NATTS. Modifications of commercially available monitors have been made to enhance their performance, and the manufacturers have continued to improve instruments to offer "high-sensitivity" options (i.e., a detection limit of about 50 ppb and resolution of 10 ppb). The principal constraints on lowering detection limits of commercially available NDIR CO monitors are detector noise, water vapor interference, and background drift. These are issues that will need to be addressed in order to obtain the sensitivity needed for NATTS.

4.2 Quality Assurance

A quality system provides a framework for planning, implementing, assessing and reporting work performed by an organization and for carrying out quality assurance procedures and quality control activities. All EPA air monitoring programs include a QA component. The EPA will fund or contribute funding to the following three toxics monitoring programs:

- National Air Toxics Trends Sites (NATTS),
- Local scale Grants, and
- Urban Air Toxics Monitoring Program (using Section 105 grant funding).

Of these three programs, the Urban Air Toxics Monitoring Program is the only one with an established quality system, and thus this system will not be discussed in this section. However, since the NATTS and the local scale grants program are under development, quality assurance activities for these programs are also under development and will be outlined in this document.

The EPA process for developing quality systems is illustrated in Figure 4. The EPA QA Policy (top tier) provides the requirements and framework for a consistent development of quality systems in order to produce data of adequate quality for decision making.

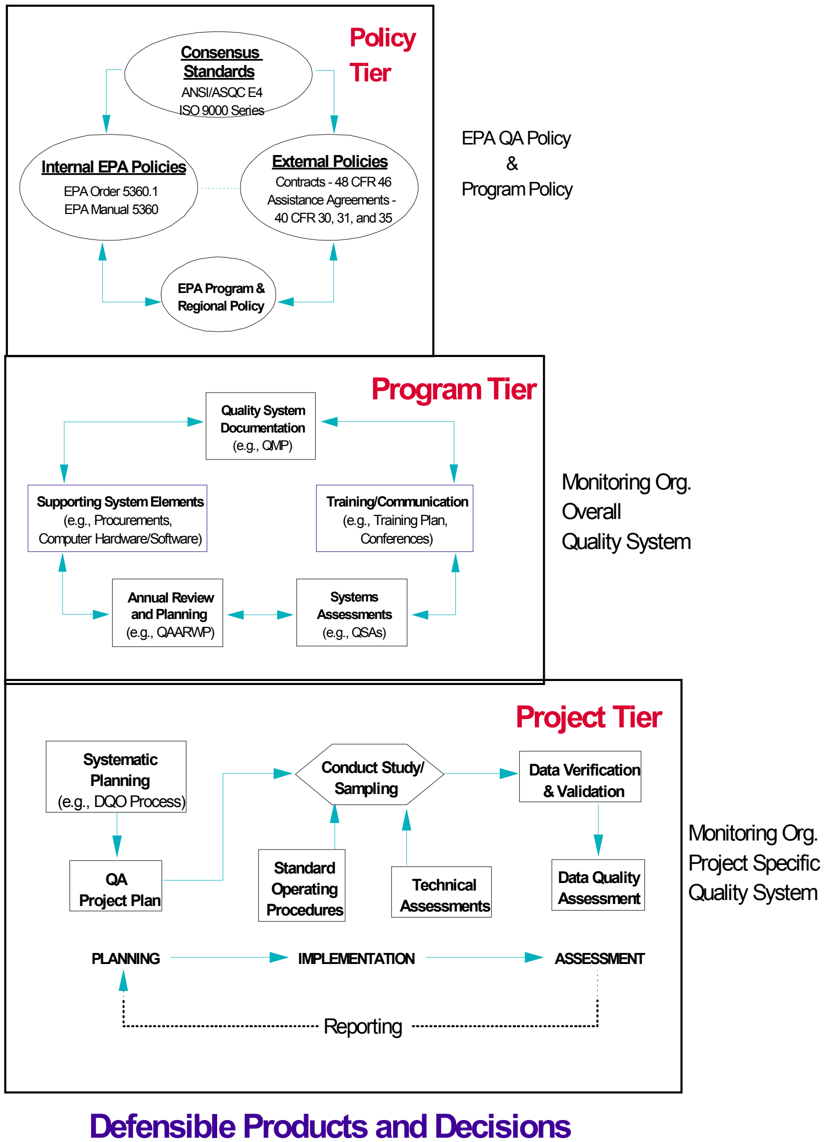

Figure 4 EPA Quality System

At the organization/program level the quality management plan (QMP) is developed for a specific organization whether it is EPA Headquarters, the EPA Regions or a State, Local or Tribal monitoring organization. In addition, a quality management plan could also be developed to describe the quality system of the major monitoring program, such as the NATTS.

The project level (lowest tier) is where specific projects are implemented and how the quality of that data is controlled and assessed to meet specific program objectives.

The following paragraphs describe the program and project specific tiers of the quality system for the NATTS and local scale project grants and the responsibilities of EPA Headquarters, the EPA Regions and the State, Local and Tribal monitoring organizations.

4.2.1 Program Tier Requirements

The program tier requirements direct development of the quality management plan for the organization or particular program. EPA Policy requires that State, Local, or Tribal (S/L/T) governments receiving financial assistance under the authority of 40 CFR Part 31 and 35 are required to develop a QMP which documents the organizations quality policy, describes it's quality system, identifies the environmental programs to which the quality system applies, and which is implemented by the organization's executive leadership. The elements included in the QMP include:

1. Management & Organization
2. Quality System & Organization
3. Personnel Qualifications & Training
4. Procurement of Items and Services
5. Documents and Records
6. Computer Hardware and Software
7. Planning
8. Implementation of Work Processes
9. Assessment & Response
10. Quality Improvement

Guidance and requirements for QMP development can be found on the EPA Quality Staff Homepage [see reference 20].

NATTS Program QMP. Since the NATTS program has specific objectives that are dependent on consistent and comparable data quality across the nation, EPA Headquarters has assumed responsibility for the development of the QMP for this program. Similar to the $PM_{2.5}$ Speciation QMP, the NATTS QMP will provide a minimum set of requirements that will be followed by all monitoring organizations participating in the NATTS. The QMP will only cover the technical elements applicable to the program and will not supersede a State, Local or Tribal monitoring organizations' QMP. OAQPS began development of the NATTS QMP in 2002 and submitted it for review to the major program stakeholders. However, in 2003 OAQPS was provided with additional resources to implement a more comprehensive quality system starting in calendar year 2004. The OAQPS QA team will revise the QMP utilizing these additional resources and submit it for review in early 2004.

Local scale grant QMP. It is assumed that the current State, Local and Tribal monitoring organization QMP will address the data quality needs for the Local scale projects grants. Most monitoring organizations have developed QMPs for their air monitoring program so new QMPs should not be required. However, for those organizations which have not developed a QMP, OAQPS has developed a graded approach for the development of QMPs and QAPPs for the Ambient Air Quality Monitoring programs that may be applicable to the Local scale projects Grants. See Appendix A for details.

4.2.2 Project Tier Requirements

This section describes the major stages of planning, implementing, assessing and reporting for the NATTS and Local scale projects Grants programs. The following project tier requirements, as illustrated in Figure 4.0, are addressed:

- Data Quality Objectives
- Quality Assurance Project Plans (QAPPs). The following activities are incorporated into the QAPP:
  - Standard Operating Procedures
  - Technical Assessments
  - Data Verification/Validation
  - Data Quality Assessments

The project tier starts with the development of data quality objectives which basically identify the level of uncertainty one is willing to accept in the data for which decisions will be made. The project tier then proceeds with the development of a QAPP, which describes the quality system to assess and control the data quality to acceptable levels.

To understand the uncertainty that is involved with the data, and to ensure that this uncertainty is within the limits as defined by the DQOs, data quality indicators are identified (precision, bias, detectability, completeness) and measurement quality objectives (MQOs) or acceptance criteria established for the overall program and through the phases of the program as necessary.

4.2.2.1 NATTS Data Quality Objectives

The Data Quality Objective (DQO) process provides a general framework for ensuring that the data collected by EPA meets the needs of decision makers and data users. The process establishes the link between the specific end use(s) of the data with the data collection process and the data quality (and quantity) needed to meet a program's goals The result of the DQO process is a series of requirements used as the basis for the detailed planning in a project-specific QAPP. An appropriatte DQO for the trends objective of the national air toxics monitoring program is:

> ***To be able to detect a 15% difference (trend) between two successive 3 -year annual mean concentrations within acceptable levels of decision error.***

Being able to detect this trend would allow one to evaluate the effectiveness of HAP reduction strategies. This is not to say that the NATTS data can not be used for other purposes, just that the development of the quality system, data quality indicators (precision, bias, completeness) and their resultant measurement quality objectives were based upon detecting the trend mentioned above.

Since it would not be feasible to develop DQOs for every toxic compound measured in the NATTS and it was a goal to establish as much simplicity and consistency in the measurement quality objectives as possible, the highest risk drivers were selected for the development of the DQOs: benzene, 1,3-butadiene, arsenic, chromium, acrolein, and formaldehyde. A detailed document on the development of DQOs for the NATTS can be found in Appendix A of the draft TAD [see reference 21].

In summary, based on variability and uncertainty estimates from the pilot city study, the specified air toxics trends DQOs will be met for monitoring sites that satisfy the goals of:

- 1-in-6 day sampling frequency with at least an 85% quarterly completeness; and
- measurement precision controlled to a CV of no more than 15%.

4.2.2.2. Local scale projects Data Quality Objectives

Since the objectives for each Local scale projects may be different, DQOs for the Local scale projects grants will need to be developed by EPA in conjunction with the grantee. The DQOs should help to justify the quality and quantity of data needed to support decisions for which the data will be used. Guidance and requirements for DQO development can be found on the EPA Quality Staff Homepage discussed earlier..

4.2.2.3 Quality Assurance Project Plan Development

As with the QMP, QAPPs are required for any environmental data operation using EPA funds. The QAPP's purpose is to document planning results for environmental data operations and to provide a project-specific "blueprint" for obtaining the type and quality of environmental data needed for a specific decision or use. The QAPP documents how quality assurance (QA) and quality control (QC) are applied to an environmental data operation to assure that the results obtained are of the type and quality needed and expected. All aspects of planning implementation, assessment and reporting described in Figure 4 should be discussed in the QAPP.

NATTS QAPP Development. The NATTS participants are required to develop QAPPs for their monitoring organization. In order to provide some consistency in the development of the quality system, the OAQPS QA team developed a model QAPP that was distributed to the NATTS managers in late 2002. This document was designed and written to be a guide for the NATTS managers to develop their individual QAPPs for their projects. The EPA Regional offices are required to approve these QAPPs.

Local scale projects Grant QAPP Development. Those monitoring organizations awarded grants for Local scale projectss will be required to develop QAPPs to assure that the results obtained are of the type and quality needed and expected. These QAPPS must be approved prior to the implementation of environmental data operations. As mentioned in the QMP section, OAQPS has developed a graded approach for the development of QMPs and QAPPs for the Ambient Air Quality Monitoring programs. This approach may be applicable to the Local scale projects Grants.

4.2.2.4 Standard Operating Procedures (SOPs)

NATTS SOPs. To ensure nationally consistent data of adequate quality (meeting the DQOs), the correct execution of specific sampling and analytical methodology is required. The methods selected must consider the data quality indicators of:

- Detectability - being able to measure the concentrations ranges required for the program;
- Completeness- being able to collect the quantity of data necessary without a high level of maintenance;
- Precision – being repeatable to an acceptable level;
- Bias – being able to maintain a concentration that does not systematically deviate from the true concentration.

The NATTS DQOs provide a means to determine the acceptable ranges of these data quality indicators. From the DQOs one can develop measurement quality objectives for various phases of the measurement process (sampling/analysis) which once established, can help an organization select or develop methods that will meet these MQOs. This is the theory behind the use of a performance based measurement system. Currently, there are only a few sampling and analytical methods available that will meet the DQOs for the NATTS. Section 4 of the NATTS Technical Assistance Document (TAD) provides strongly suggested guidance for the consistent use of sampling and analysis methods for the NATTS. Through QAPP reviews and technical systems audits (TSAs), significant deviations that could affect the quality of the data will be identified and discussed to ensure that the methods will meet the DQOs.

As part of the QAPP development process, NATTS participants are required to develop SOPs in details specific to their environmental data operations. As an example, it is not appropriate to simply reference Toxic Organic (TO) Compendium 15 in the QAPP as the method for use since there are a number of options included in that method that any organization would have to select as the option used for their procedure.

If sub-contractors are used by the NATTS monitoring organization, then the contractors must submit their SOPs to the NATTS monitoring organization for incorporation into the QAPP prior to EPA Regional office review and approval.

Local scale projects SOPs. As part of the development of the Local scale projectss QAPPs, SOPs for all environmental data operations must be developed and submitted with the QAPP prior to implementation of environmental data operations. The 2004 State and Local Agency Grant Guidance and Allocation states that "all work done with this funding will need to follow the field and measurement protocols as outlined for NATTS sites…" However, EPA does not want to affect the use of newer technologies that meet the objective of the Local scale projects study.

It is an objective that data from the NATTS and the Local scale projectss will be of comparable quality so that the Local scale projects data can augment the NATTS where possible. For those measurements that are common to the NATTS, it is suggested that the NATTS sampling and analysis protocols be followed to enhance consistency between Local scale projects projects and the NATTS. Where non-standard technologies are proposed to be used, the sponsoring agency must report within their QAPP/SOPs, the quality controls that will be deployed that will allow for the a comparison of data quality of this non-standard technology. This would include providing information on the data quality indicators of detectability, precision and bias, their frequency and the acceptance criteria. Such controls could include demonstration of instrument performance that meets or exceeds standard methods under expected concentration regimes. In addition, analyses quantifying the added benefit of more temporally resolved data to improve characterization relative to standard integrated methods, or other approaches that illustrate how such technologies offer an advantage to meeting monitoring objectives. These must be accepted by the EPA Regional Offices.

As mentioned in the NATTS section, the TAD contains the methods for NATTS sampling and analysis. These methods can be used for the Local scale projects studies as long as details specific to the monitoring organization are reported.

If sub-contractors are used by the community monitoring organization, then the contractors must submit their standard operating procedures to the community monitoring organization for incorporation into the QAPP prior to EPA Regional office review and approval.

4.2.2.5 Technical Assessments

An assessment is an evaluation process used to measure performance or effectiveness of a system and its elements and is an all inclusive term used to denote audits, performance evaluations, proficiency tests, management systems audits, peer review, inspection or surveillance.

The following paragraphs outline the components of the NATTS technical assessments**.** Due to the one-year duration of Local scale projectss grants, it is not anticipated that external technical systems audits would be performed on the monitoring activities of these grants. The laboratory technical systems audits, proficiency tests and calibration certification will be made available only if the laboratories used in the Local scale projects happen to be participating in the NATTS program, otherwise they will not be included in these external assessment activities. These assessments could be made available if the timing of grant activity could be coordinated with funding and planning for these assessments for the NATTS.

Technical Systems Audits (TSA) – A technical systems audit is a thorough, systematic, on-site, qualitative audit of facilities, equipment, personnel, training, procedures, recordkeeping, data validation, data management and reporting aspects of a quality system.

- **Laboratory TSA -** EPA, using contractors and EPA Regional offices, will attempt to perform 12 audits a year of the laboratories performing analysis for the NATTS. It is expected that audits of all laboratories would be completed in 2 years. An audit check sheet will be developed in order to provide a consistent evaluation across all laboratories. Reports on these audits will be included in an Annual QA Report.
- **Field TSA –**The EPA Regional Offices will perform TSAs on field activities during there normal TSA audit schedules.

- **Internal TSA –** Monitoring organizations as part of the internal quality system procedures may perform technical systems audits of the environmental data operations as described in their QAPP.

Proficiency Tests (PT) - A PT is a type of assessment in which a sample, the composition of which is unknown to the analyst, is provided to test whether the analyst/laboratory can produce analytical results within the specified acceptance criteria. OAQPS proposes the use of quarterly PT studies for the NATTS program laboratories using the following process:

1. Decide on the **audit constituents** and the **concentration levels**.
2. Find an independent organization to develop the PT samples. The organization (vendor) that creates the PT samples must not perform analysis for any of the NATTS State or Local Agencies.
3. The independent organization/vendor will certify the audit concentration and constituents through the National Institute of Standards and Technology (NIST). PT materials will be developed that would be sent to NIST for analysis and certification. The appropriate confidence limit window would be identified. This information would be reported from NIST to OAQPS for review/approval of audit. Contractor payment of an audit set would be dependent on the NIST/Contractor concentration comparison. Failure would require development of a new PT audit. OAQPS may/may not have to develop and independent contract with NIST in order to ensure analysis and reporting to OAQPS.

Calibration Cylinder Certification -OAQPS, in conjunction with Office of Air and Radiation (ORIA) laboratory in Las Vegas, Nevada, will be implementing a program where the VOC calibration cylinders will be sent from the NATTS analytical laboratories to ORIA for certification. In the future, if the laboratories agree to the process, OAQPS could perform a national purchase of calibration cylinders and certify their concentration prior to use by the laboratories.

Through-the-Probe Performance Evaluation –Since 2001, OAQPS has been reinventing the mail-able National Performance Evaluation Program to a through-the-probe audit activity for the criteria polltants. Trailers and/or mobile laboratories visit a monitoring site and challenge the monitors with audit gases through the inlet instead of the back of the monitor. OAQPS will look at augmenting the current NPEP trailers/labs with the equipment to provide similar audits to the NATTS sites for VOCs and aldehydes in calendar year 2005.

4.2.2.6 Verification and Validation

Verification is confirmation by examination and provision of objective evidence that **specified requirements** have been fulfilled. Validation is confirmation by examination and provision of objective evidence that the particular requirements **for a specific intended use** are fulfilled.

It is the responsibility of the State, Local and Tribal monitoring organizations and their contractors that operate, collect and analyze the samples to perform the data validation and verification of the data before it is submitted to the Air Quality System (AQS) national database. The procedures for validation and verification should be detailed in their QAPPs, and therefore reviewed by the EPA Regional offices.

In addition, there is the VOCdat software tool that was developed through funding by US EPA which is free and available to the public. This tool can be used to validate and get the data into a format that can be sent to the AQS. [see reference 22].

NATTS Verification and Validation. Due to the fact that the DQOs (a specific intended use) have been identified, OAQPS with the help of the EPA Regions and NATTS stakeholders can develop consistent data verification and validation criteria similar to the validation templates developed for the $PM_{2.5}$ program. OAQPS will incorporate the verification/validation templates into the quality management plan expected for completion in 2004.

Local scale projects Verification and Validation. Through the development of the project specific QAPP, monitoring agencies will be required to develop their project specific verification and validation procedures.

4.2.2.7 Data Quality Assessments and Reporting

A data quality assessment (DQA) is used to determine whether the type, quantity, and quality of data needed to support a decision (the DQO) has been achieved.

NATTS DQA and Reports. OAQPS will hire a contractor to create a Quality Assurance Annual Report (QAAR). The QAAR will document the information on the data quality indicators and independent assessments (TSAs, proficiency tests, certifications) that are performed within a calendar year. These results will then be compared against the MQO criteria for this program. The annual report will be utilized by OAQPS, EPA Regional Offices and NATTS stakeholders to assess the status of the program. If problems are identified, corrective steps by the NATTS State and Local Agencies, with the input of the EPA Regional offices will be undertaken.

After the first 3 years of NATTS monitoring, a more interpretive DQA will be performed to determine whether the assumptions and data quality requirements used to develop the DQOs are being achieved.

Local scale projects DQA and Reporting. The project specific QAPPs will describe that type of QA report that will be distributed as part of project reporting. The QA report does not need to be an independent report but should indicate whether the quality of data anticipated for the program was achieved. At a minimum, information on detectabilty, precision, bias and completeness must be addressed.

5. Integration with Other Monitoring Programs

A brief discussion covering integration across programmatic, network, and specific measurements provides context for linking the emerging air toxics network with other programs. Programmatically, most air pollution issues are well integrated through an assortment of technical pathways. For example, combustion sources such as motor vehicle exhaust emit ozone and particulate matter precursors (nitrogen and sulfur oxides, VOCs) and primary "air toxics" emissions (specific VOCs such as benzene). Particulate matter provides surfaces that carry numerous HAPs, particularly the heavier organic compounds broadly referred to as semi-volatile organic compounds (SVOCs) that include polycyclic aromatic hydrocarbons (PAHs). Several metals of interest to the air toxics program exist in the solid phase and constitute a fraction of particulate matter. In many instances, the photochemical and oxidation reactions in the atmosphere that underlay ozone production and secondary particulate matter formation have a marked effect on air toxics. Examples include the secondary formation of formaldehyde and the loss of reactive HAPS such as toluene and xylene through atmospheric reactions that eventually yield ozone. Perhaps the most obvious cross PM-HAPS issues are the national concerns associated with "diesel PM" and "woodsmoke "PM.". Both of these topics are concerned not just with the mass of PM, but with specific harmful PAH compounds associated with diesel and woodsmoke emissions. Clearly, air toxics issues are closely linked scientifically with ozone and particulate matter. Out of a need to focus accountability on individual pollutant progress, and perhaps tradition, we manage program budgets in a monotonic matter.

While respecting the resource boundaries across pollutant programs, we must leverage all programs to realize economies that are born out of the natural integration across pollutant categories. To that end, it becomes incumbent upon us to seek integration with all monitoring networks as the air toxics network is conceived and ultimately deployed. The air toxics network presents an excellent opportunity to leverage existing networks, and foster the development of related new networks. The National Air Monitoring Strategy (NAMS) has promoted the need to enhance multiple pollutant monitoring in recognition of the scientific linkages across pollutant categories. The National Core (NCore) monitoring network concept enhances the leveraging of existing networks and adds a minimum of needed pollutant measurements that currently are not conducted on a routine basis. Within the NCore design, approximately 75 NCore Level 2 multiple pollutant sites are to be based at existing $PM_{2.5}$ speciation sites, with the addition of trace level nitrogen, sulfur dioxide, and carbon dioxide gaseous measurements. The 22 NATTS are intended to be part of the NCore Level 2 sites. The NATTS benefit from a well developed infrastructure (monitoring platform, power, operators) and the NCore network is enhanced by having an incredibly rich set of measurements provided through NATTS.

More specific measurement integration has been fostered by the NATTS in two areas. First, measurements of light absorbing carbon through aethalometry were added to the NATTS list. Light absorbing carbon is a possible marker of "diesel PM" and cuts across air toxics and PM programs. Existing funds from the $PM_{2.5}$ Section 103 program are used to fund this component of the NATTS, justified on the basis that light absorbing carbon benefits the PM program and was a specific recommendation to EPA through the CASAC PM monitoring subcommittee. PM diesel often is ranked as the highest risk factor across all air toxics parameters. Second, as part of the NATTS, trace level CO monitors will be added on a test basis at four locations with FY04 funds from the air toxics NATTS resource base. The air toxics justification for adding CO is based on the desire to provided continuous measurements (i.e., at least at hourly intervals) of a surrogate for other combustion products, such as benzene and 1,3 butadiene that traditionally are captured only with integrated 24-hour samples every sixth day. It is expected that the co-location of continuous CO with periodic canister samples for VOCs will result in well defined correlations (with location and seasonal dependencies) that will enable a very robust extension of the limited 1-in-6 day VOC samples. This recommendation also emerged from the National Academy of Science Study on CO pollution [see reference 15]. In this case, the CO measurements provide an opportunity to explore the issues of operating trace level CO measurements by routine agencies before a major investment is made in NCore, while at the same time the toxics program marches forward in promoting continuous methods to complement the abundance of integrated methods used for every recommended NATTS pollutant. Moreover, the incorporation of CO virtually benefits every air pollution program, as CO is a key conservative tracer that should be used in air quality model and emission inventory evaluations for all pollutant programs. In addition, CO is a key co-pollutant requested by the health effects and exposure community to truly disentangle effects associated with various pollutant categories.

The emerging local scale project programs have considerably more flexibility to explore program leveraging and integration relative to the NATTS. For example, many communities view potential toxicity associated with diesel PM or wood smoke to be their highest air toxics concern. Accordingly, the local scale projectss have the ability to explore more deeply the connections across PM and toxics by performing more in depth analysis of specific marker HAP compounds associated with these categories.

6. Relationship to Specific Air Quality Programs

The following discussion provides a very brief overview of major air quality programs addressing air toxics. One of the major challenges facing the monitoring program is providing measured data that account for the progress, in terms of ambient concentration changes, resulting from program deployment. While measuring program progress is a goal of the monitoring effort, a few cautionary remarks are in order to provide realistic expectations of the ability of the program to meet accountability objectives. Several of the programs (e.g., several MACT rules) discussed below have been implemented over the last decade and, therefore, the ability to reference a starting baseline for progress measurement has been lost. In certain instances, the ability to adequately capture signals attendant with "program induced" atmospheric improvements will be conflicted due to methodological issues, lack of adequate resources or extremely low signal detectability. The program must be constantly vigilant and allow for adequate flexibility while focusing on problem solutions that enable true measures of environmental progress. This ongoing vigilance could, for example, shift the emphasis of the program to more deeply probe those areas associated with significant residual risk issues that have been identified through the local studies or other assessments.

6.1 Mobile Source Rules

Many motor vehicle and fuel emission control programs have resulted or will result in substantial reductions in ambient levels of air toxic pollutants. Several of these programs specifically address mobile source air toxics, such as reformulated gasoline and anti-dumping standards, and the anti-backsliding provisions in the 2001 mobile source air toxics rule, which require refiners to maintain over-compliance with the reformulated gasoline and anti-dumping standards. Other programs put in place primarily to reduce emissions of volatile organic compounds and particulate matter also have reduced and will continue to reduce air toxics substantially. Recent milestones which result in reduced mobile source air toxic emissions are summarized in Table 7. In addition to these milestones, inspection and maintenance programs, and voluntary programs, such as diesel retrofits, Clean School Bus USA, and commuter choice initiatives are all effective in reducing air toxics. OTAQ estimates that its programs will reduce air toxic emissions by over one million tons, or 35%, between 1996 and 2007. Furthermore, in its recent mobile source air toxics rule, EPA projects that, between 1990 and 2020, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene and acetaldehyde by about 70%.

In order to track the impacts of these mobile source programs through monitoring, it is important to understand what is happening at both the regional and the local level. The existing air toxics monitoring network is capable of assessing mobile source trends at the regional scale, in conjunction with source apportionment tools to estimate the mobile source contribution to ambient levels. An understanding of localized impacts is needed to characterize spatial gradients in ambient air toxics from mobile sources, as well as to evaluate impacts of control programs in potential mobile source "hotspots." To do this, mobile source dominated sites must be identified. Also, monitors should be sited within the zone of influence near a major roadway. This zone of influence is typically within somewhere between 100 and 500 meters of a major roadway. Ambient air quality modeling, using link level highway mobile source inventories, can be used to identify sites meeting these criteria.

Table 7. Recent Milestones in Reducing Mobile Source Air Toxics [see reference 23]

Year	Milestone
1991	EPA establishes lower tailpipe standards for hydrocarbons and nitrogen oxides as required by the 1990 CAA. Standards take effect beginning with 1994 models.
1995	Reformulated gasoline and anti-dumping standards go into effect, beginning in 1995.
1995	On-board diagnostic systems required in 1996 model year cars.
1996	EPA issues regulations which will reduce hydrocarbon emissions from marine engines 75% by 2020
1998	EPA issues new emissions standards for diesel engines used in nonroad construction, agricultural, and industrial equipment, as well as in certain marine applications.
1999	Vehicles meeting national low emission vehicle (NLEV) standards first sold in the Northeast, and in the rest of the country beginning in 2001
1999	EPA announces more stringent tailpipe and gasoline sulfur standards to be implemented beginning in 2004.
2000	EPA adopts a final rule for nonroad small spark-ignition handheld engines such as trimmers, brush cutters, and chainsaws.
2001	EPA develops a comprehensive national control program that will regulate the heavy-duty vehicle and its fuel as a single system. These new standards will apply to model year 2007 heavy-duty on-road engines and vehicles.
2001	EPA promulgates a motor vehicle air toxics rule which codified existing overcompliance with Federal reformulated gasoline and anti-dumping standards
2003	EPA proposed new standards further reducing emissions from nonroad diesel engines and limiting sulfur levels in nonroad diesel fuel.

6.2 Point Source Rules

The CAA provides several regulatory mechanisms for EPA to reduce HAP emissions from point sources including MACT standards [Section 112(d)], residual risk standards [Section 112(f)], and area source standards [Section 112(k)]. MACT standards require large emitters of HAP (e.g., power plants) to reduce HAP emissions to the lowest feasible level. Residual risk standards will be developed for those industries which EPA believes still pose an unacceptable level of risk after complying with the applicable MACT standards. Finally, area source standards will be developed to reduce HAP emissions from industries where individual sources emit smaller amounts of HAP but where the number of sources are large (e.g., dry cleaners.) The following paragraphs provide more detail on the point source regulatory programs authorized under the CAA and how air toxics monitoring data can be used to support these programs [see reference 24].

6.2.1 MACT Standards

The EPA is required by the CAA to develop MACT standards for every industry that emits 10 tons per year (tpy) or more of a single HAP, or 25 tpy or more of a combination of HAP (i.e., major sources of HAP). MACT standards are often referred to as technology based standards because they are based on the emission limitations achieved by the best emissions control technologies and work practices available to reduce emissions, without consideration of human health risks. The standards are typically expressed as not to exceed emission limits, or work practice standards such as raw material substitution requirements. Facilities demonstrate compliance with these standards by periodic stack tests and parametric monitoring.

The EPA began developing MACT standards in 1990. As of November 2003, the EPA had finalized 88 standards covering 162 industries. There are currently MACT Standards for nearly all major sources of HAP, with only 4 more standards scheduled to be finalized in early 2004. Because the MACT program is nearly completed, it will not be possible to use data gathered from the air toxics monitoring network to help in the development of MACT standards. A complete list of industries regulated by the MACT program and the corresponding compliance dates can be found at http://www.epa.gov/ttn/atw/mactfnl.html.

It may be possible to use the data gathered from the NATTS to evaluate the impact of the MACT standards on ambient HAP concentrations. While many industries have already been required to comply with their respective MACT standards, nearly half of the industries regulated under the MACT program will not be required to comply with the standards until the year 2005. The HAP emission reductions achieved by these standards are expected to have very significant impacts on the HAP concentrations in those communities near affected facilities, but only limited impact at the National scale. NATTS sites that have been placed in communities influenced by these affected facilities may be able to measure the impact of these standards on the surrounding communities as the facilities reduce emissions in order to comply with the MACT standards. Due to the short term nature of the local scale projects, it is unlikely that meaningful conclusions can be obtained regarding the impact of the MACT program from the local scale projectss.

6.2.2 Residual Risk Standards

The Residual Risk program is the second phase of regulating major sources of HAP mandated by the CAA. As discussed above, the EPA did not consider risk in developing MACT standards. Therefore, the Residual Risk program is intended to determine if HAP emissions from industrial facilities pose an unacceptable human health risk or adverse environmental effects after implementation of the MACT standards. If an industry is found to pose an unacceptable risk, additional standards will be developed in order to provide an ample margin of safety to protect public health and prevent any adverse environmental effect.

The EPA will perform a risk assessment for each industry regulated by a MACT standard. The EPA is in the early stages of the Residual Risk program, with the first residual risk standard scheduled to be finalized in late 2003. Risk assessments for nineteen other industries are in various stages of completeness. Ultimately, risk assessments for over 150 industries will be prepared under the Residual Risk program.

The exact approach used in assessing risk for each industry will vary depending on the complexity of the industry, the number of facilities, and many other industry specific issues. However, the basic steps in each assessment include hazard identification, dose-response assessment, exposure assessment, and risk characterization. A report to congress was prepared that details the overall approach used in preparing the risk assessments. Interested parties can obtain a copy of the report at http://www.epa.gov/ttn/oarpg/t3/reports/risk_rep.pdf. Additional discussion regarding risk assessment is provided in later sections of this document.

Of the steps in a risk assessment, one of the most difficult and data intensive steps is estimating the ambient HAP concentrations due to the facilities HAP emissions. It is not possible to monitor every location around every facility to determine the ambient HAP concentrations. As such, the EPA relies on emission inventories and dispersion modeling to estimate maximum HAP concentrations around facilities. However, the early residual risk projects have raised several questions, including the following:

- Are the emission inventories accurate?
- Do the models accurately estimate ambient HAP concentrations?
- What are the background HAP concentrations?

The data generated from the NATTS and the local scale projectss will be very useful in answering these questions and others that arise as the EPA moves forward with the Residual Risk program.

6.2.3 Area Source Standards

Both the MACT program and the Residual Risk program target industries where individual facilities emit large amounts of HAP. The Area Source program is intended to develop standards that regulate a targeted group of HAP emissions from industries where individual facilities emit smaller amounts of HAP, but where the number of sources are large enough that collectively the industry emits a significant amount of HAP. Familiar examples of areas sources include dry cleaners and gas stations.

The EPA is in the early stages of the Area Source program. The EPA has identified a total of 70 area source categories, which represent 90 percent of the emissions of the 30 air toxics that pose the greatest potential health threat in urban areas. Of these 70 area source categories, 14 source categories have already been regulated. The remaining area source standards are under development or will be developed in the future. The complete list of area sources currently listed for regulation can be found at http://www.epa.gov/ttn/atw/urban/arerules.html.

The data gathered from the local scale projects will be extremely useful as the EPA moves forward with the Area Source program. Each assessment will provide a "snap shot" of the current levels of HAP in a given community as well as which emission sources have the most impact. The EPA may be able to use this information to prioritize the list of area source categories as well as identify additional area source categories that should be included based on the health threat they pose in urban areas. Furthermore, the EPA has discretion in determining the level of stringency of area source standards. As such, data demonstrating that specific area source categories pose a potential health threat in urban areas will be valuable in arguing for stringent standards for those source categories. In addition, this data will also be important for use in developing and evaluating the next generation of new and improved modeling techniques for air quality and human exposure.

7. Next Steps

7.1 Collect and Report Air Toxics Data

State and local agencies, using grant funds from EPA and other available resources, should install and operate the planned NATTS and local scale project monitors. All monitoring shall be performed in accordance with the approved QAPPs. Quality assurance procedures shall be followed. All air quality data must be reported quarterly to EPA's Air Quality System.

7.2 Meet Data Quality Objectives

As discussed in Section 3, a vigorous quality assurance program will be implemented in 2004 for the national network. In relation to the trends objective, the goal for the NATTS is to ascertain a 15 percent change in toxic compound concentrations between two 3-year periods. For example, for the calendar years of 2004 through 2006, statistical averaging will occur to obtain the average annual concentrations for each pollutant. Then, for the years 2007 through 2009, the process will be repeated. The difference between these two averages will yield the change in concentrations. (This concept is also discussed in Section 4.2.2.1.)

To be able to obtain a valid comparison, it is imperative that methods employed through the years are consistent. Due to emerging and improving technologies, this task may be difficult. However, the program team is making the utmost effort to resolve lab and sampling issues (for example, switching from a high-vol PM_{10} sampler to a low-vol PM_{10} sampler) early in 2004 so that accurate trend assessments can be made. For comparisons needed among differing methods and analyses, statistical adjustments and assumptions will have to be made.

7.3 Analyze Air Toxics Data

As discussed in Section 2, local-scale studies will yield data on a yearly basis that will be aggregated and analyzed along with the NATTS data. As funding permits, "snapshots" of localized problems will emerge from the blending of these two data sets.. A national data analysis contract (to be managed by EPA) will provide a cursory examination of the NATTS and local scale project's data on an annual basis. Individual communities are encouraged to conduct additional, more in-depth analyses of their data to ensure that their monitoring objectives are adequately being addressed. In addition, an annual data analysis workshop will be held by EPA to report the results of the national and any local data analyses, and provide training opportunities.

7.4 Characterizing Risk and Assessing Reduction Strategies

To understand and properly quantify the health and environmental risks associated with ambient emissions of air toxics, it is important to know to what levels of a pollutant people and ecosystems are actually exposed. In general, ambient air concentrations, produced by fixed station monitors, do not directly estimate long-term human inhalation exposures (although they may be appropriate for ecosystem exposure). Such exposures are either measured with personal monitors, which follow a human subject through time and space, or are predicted with exposure models, which simulate long-term human activities. However, ambient monitors indirectly provide information that is essential to a proper exposure and health risk characterization.

To date, long-term widespread databases of personal exposure monitoring for many pollutants is limited (and have been developed primarily by organizations outside of the agency). Thus, most inhalation exposure characterizations currently rely on model predictions of inhalation exposure. A key component to these models is to properly characterize the concentration in the different "indoor and outdoor places" where people spend their time (called "microenvironments or MEs"). Research has shown that for many pollutants there is a definitive relationship between the outdoor ambient concentration and that found in these MEs (i.e., home, vehicles, workplace, park). Thus, in most exposure models, the outdoor ambient concentration along with ME relationships and human activity pattern data (an accounting of which MEs people spend their time in) are used to predict human inhalation exposure concentrations. With adequate temporal and spatial coverage ambient monitor data can serve as the required outdoor ambient concentration for these exposure model. Where adequate coverage does not exist, exposure assessments can rely on air dispersion models to provide the air quality data at the required temporal and spatial coverage

When evaluating exposures from criteria air pollutants (ozone, carbon monoxide, etc.), past regulatory exposure assessments have relied on ambient measurements from fixed-site monitors for use in exposure models. This could be accomplished because routine long-term ambient monitoring data for such pollutants were available to a high degree of spatial resolution in many metropolitan areas. For exposure assessments in support of the ozone national ambient air quality standard development, 6-16 monitoring sites in 9-10 areas around the country have been used to help estimate concentrations in MEs. For most air toxics pollutants, a comparable spatial monitoring resolution is generally not available nor is it currently practical from a cost point of view. As a result, exposure assessment for air toxics are typically driven by ambient concentration estimates from dispersion models. In addition to filling the void of assuring adequate spatial coverage, dispersion models also have the ability to predict future concentrations or evaluate the past effects of various emissions scenarios on ambient concentrations. For example, EPA is currently performing a national screening assessment which will calculate human exposures based on modeled ambient levels from a nationwide dispersion model (the Assessment System for Population Exposure Nationwide, or ASPEN). The ASPEN system calculates these ambient levels based on a knowledge of meteorology, chemistry, and rates at which air toxics pollutants are emitted into the atmosphere from all man-made sources in the nation (this information is compiled in EPA's 1996 National Toxics Inventory, NTI).[see reference 25]. The ambient concentration outputs from ASPEN are then used to calculate human exposures using the exposure model the Hazardous Air Pollutant Exposure Model (HAPEM5). Estimated exposures from HAPEM5 will then be combined with quantitative health impact information to estimate population health risks estimates. Thus, as noted in Section 2.2, the role of ambient monitoring data in the model evaluation process will be an essential step in assuring the appropriateness of the predicted exposure and health risk estimates.

8. Roles and Responsibilities

The following organizations and committees are an integral part of the NATTS Monitoring Program and overall National Network:

SAMWG Air Toxics Monitoring Subcommittee. This group is a combination of State and Local Air Pollution Control Agencies, EPA-OAQPS and EPA Regional representatives. Their charge is oversight of site selection, long range planning, funding allocation, and general decision making for the NATTS. Their ongoing challenge is balancing national and local needs and addressing overarching technical issues as they arise. The current members are listed in Table 8.

Table 8. SAMWG Air Toxics Monitoring Subcommittee

Subcommittee Member	Agency
Richard Scheffe	US EPA Monitoring and Quality Assurance Group, OAQPS
Fred Dimmick	US EPA Air Quality Trends and Analysis Group, OAQPS
Sally Shaver	Director, US EPA Emission Standards Division, OAQPS
Michael Koerber	Executive Director, Lake Michigan Air Directors Consortium
Steve Spaw	Director of the Monitoring Operations Division, Office of Compliance and Enforcement, Texas Commission on Environmental Quality.
Michael Gilroy	Puget Sound Air Agency, Washington state
Dick Valentenetti	Air Director, Vermont Natural Resources
Gregg Lande	Air Quality, Oregon Dept. Of Environment
John Kennedy	US EPA Region IX
Tim Watkins	Assistant Director, National Exposure Research Laboratory, US EPA

STAPPA/ALAPCO. The State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) is a major contributor to the air toxics field. EPA and STAPPA/ALAPCO maintain a common Internet Web page [26], where information on air toxics rules and regulations can be reviewed. STAPPA/ALAPCO also has two member on the SAMWG Air Toxics Monitoring Subcommittee. They provide State/Regional/Local perspective to the NATA and specifically, the NATTS.

Office of Air Quality Planning and Standards. OAQPS is the organization charged under the authority of the Clean Air Act (CAA) to protect and enhance the quality of the nation's air resources. OAQPS sets standards for pollutants considered harmful to public health or welfare and, in cooperation with EPA Regional Offices and the States, enforces compliance with the standards through regulations controlling emissions from stationary sources. OAQPS evaluates the need to regulate potential air pollutants and develops national standards.

Within OAQPS, the Emissions Monitoring and Analysis Division (EMAD), the Monitoring and Quality Assurance Group (MQAG) will be responsible for the oversight of the NATTS. Staff from both the EMAD and the Emission Standards Division (ESD) contribute to the following tasks:

< Ensuring that the methods and procedures used in making air pollution measurements are adequate to meet the programs objectives
< Convene SAMWG Subcommittee meetings,
< Oversee national QA program (discussed later in this plan),
< Develop and distribute guidance and data,
< Evaluate national risk,
< Develop model to monitor comparisons using NATTS data,
< Provide issue resolution.
< Manage national data analysis contract and hold annual data analysis workshop.
< Communicate status and report data results of the ongoing program.

Office of Research and Development. The office of Research and Development (ORD) is charged with the research and development of the air toxics samplers and technical oversight:

< Oversee development and testing of new air toxics instrument designs;
< Work closely with OAQPS to determine that the NATTS instruments are being operated in accordance to their design;
< Evaluate ambient data as it is collected and work with the research community to ascertain the meaning of the results with respect to atmospheric processes, human exposure and health effects.
< Develop new measurement methods.

EPA Regional Offices. EPA Regional Offices address environmental issues related to the states within their jurisdiction and to administer and oversee regulatory and congressionally mandated programs:

< Oversee NATTS monitoring sites in their purview,
< Aid in AQS uploads,
< Review QAPPs (refer to Quality Assurance section below)
< Disburse grants,
< Resolve local issues,
< Keep OAQPS and the ATSC informed of issues.

National Air and Radiation Environmental Laboratory. At this time, the National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama, which is an Office of Radiation and Indoor Air (ORIA) laboratory is being considered as having a Quality Assurance role in the NATTS. NAREL will fill this position if funds are made available. If not, OAQPS will select another quality laboratory to fill this specific role.

State, Local and Tribal Air Monitoring Agencies. The S/L/T agencies are tasked in operating the samplers in the field and in some cases, analyze the samples at their own or contract laboratory facilities. The S/L/T agencies may decide to use the UATMP. Their tasks are:

< Develop quality assurance and network plans (refer to the Quality Assurance section below);
< Participate in workgroup calls on quality assurance and laboratory issues,
< Carry out monitor placement, sample collection and analysis,
< Meet requirements of the national network,
< Meet requirements of their respective Regional offices.

9. Schedules

The following table outlines planned monitoring network deadlines and general product development.

Table 9. Timeline

Date	Product	Anticipated Result
August 2002- July 2003	All ten pilot city data entered into AQS	Data used for base of national network design and monitor-to-model comparisons
January 2003	Section 105 Grants (NAAQS reprogramming - recurring award of $6.5 million)	Allow for expanded air toxics monitoring at existing monitoring stations nationwide; administered at the Regional level.
May 2003	Pilot project results presented at annual data analysis workshop.	Provide air toxics monitoring community all information on pilot project and network design. Data results used to validate and revise monitoring network as planned.
July 2003	Draft TAD uploaded to AMTIC	Help develop consistency among the NATTS sites.
August 2003	FY2004 Guidance distributed	Funding for continuation of NATTS sites, addition of high resolution CO, continuous formaldehyde, hexavelent chromium instruments, and local scale studies.
October 2003	Methods Workshop for Air Toxics Monitoring Community	To bring together state and national experts on inorganic measurement issues - alter methods/analysis procedures for NATTS if appropriate.
January 2004	Roll-out of second phase of trends sites	NATTS network established.
May 2004	Local scale studies chosen	Between 10-15 local scale projects approved - all data to be uploaded to AQS for use in multiple studies of characterization, risk and trends.
May 2004	Final Draft Technical Assistance Document released	Will form the technical basis of National Program- widely distributed and published on AMTIC, updated as needed.
July 2004	Performance Evaluation and round robin samples distributed to each participating NATTS lab.	To measure precision, accuracy and bias - both quarterly and annual (technical system audits.)
January 2005	Specialized instrument studies begin at NATTS sites. All local scale studies in place.	
Ongoing every spring.	Annual grant guidance issued Annual data analysis workshop	Annual data analysis workshop will be expanded with training modules, and also discussions of analytical methods and analysis issues.

10. Training

The Quality Management Plan (available in late summer 2004) discusses training, however funds are limited. Any NATTS agencies contracting with the UATMP contractor can obtain training on sampler operation and sample handling techniques. In addition, EPA provides training on basic data analysis and AQS data entry as funding becomes available. There will also be training opportunities for participants of the yearly data analysis workshop, which are tentatively scheduled each spring. Network participants should also contact their Regional representatives for information on available training in their area.

11. Communications

There are literally hundreds of technical, policy and administrative staff involved in the NATTS. In addition, decision makers at all levels need continual information on issues and developments of the program. To satisfy these needs, continuous communication between the US EPA and participating staff is imperative, through publications, conference calls, public notices, workshops and meetings. The following table demonstrates the products that are created to help with this communications effort.

Table 10. Communications Schedule

Date	Product	Desired Outcome
Monthly	Quality assurance/general network conference calls.	To inform NATTS staff (EPA and loca/state managers) of current issues and issue resolution.
Quarterly	US EPA/STAPPA ALAPCO Newsletter	Provides stakeholders and the public updated information related to the National Air Toxics Monitoring Network [see reference 21]
Spring each year.	NATTS Technical Grant Guidance	Funding allocation and network implementation
Spring each year.	Data Analysis Workshop	Provide air toxics monitoring community all information on pilot project and network design.
Yearly	US EPA Trends Report	To inform public of trends and current events surrounding the NATTS.

12. References

1. US EPA Strategic Plan, September 2000, EPA-190-R-00-002. This document is at: http://www.epa.gov/budget/plan/2000strategicplan.pdf

2. National Air Toxics Assessment (NATA). Detailed discussion of the NATA can be found at: http://www.epa.gov/ttn/atw/nata/index.html

3. Comparison of ASPEN Modeling System results to Monitoring Concentrations - http://www.epa.gov/ttnatw01/nata/mtom_pre.html

4. Integrated Air Toxics Urban Strategy, information and overview. http://www.epa.gov/ttn/atw/urban/urbanpg.html

5. NATA Summary of Results. http://www.epa.gov/ttn/atw/nata/risksum.html

6. The US EPA Air Toxics Concept Paper, draft, February 2000. http://www.epa.gov/ttn/amtic/files/ambient/airtox/cncp-sab.pdf

7. Review of the Draft Air Toxics Monitoring Strategy Concept Paper. Http://www.epa.gov/sab/pdf/ec0015.pdf

8. Discussion of the Air Toxics Data Archive, Battelle Laboratories. http://www.battelle.org/environment/apm.stm

9. National Air Toxics Monitoring Program-Community Assessments. Office of Air and Radiation Grants and Funding website. http://www.epa.gov/air/grants_funding.html#oaqps

10. Interagency Monitoring of Protected Visual Environments (IMPROVE) program. See http://vista.cira.colostate.edu/improve/

11. LADCO Air Toxics Website listing the 2000 pilot project data analyses and recommendations. http://64.27.125.175/toxics.html

12. Clean Air Status and Trends Network (CASTNET). http://www.epa.gov/CASTNET/

13. US EPA National Air Toxics Technical Assistance Document (TAD), draft. (Draft final to be uploaded May 2004.) http://www.epa.gov/ttn/amtic/files/ambient/airtox/drafttad.pdf

14. Northeast States for Coordinated Air Use Management (NESCAUM) Air Toxics Methodology Issues. http://bronze.nescaum.org/committees/monitoring/oct03toxicsworkshop/

15. US EPA Compendium of Methods - Air Toxics Methods.

http://www.epa.gov/ttn/amtic/airtox.html

16. California Air Resources Board S.O.P. No. MLD039- Extraction and Analysis of Hexavalent Chromium by ion Chromatography. http://www.arb.ca.gov/aaqm/sop/summary/sop039.htm

17. Acrolein capture using the DNSH method. Personal communiation, Donald Whitaker, US EPA Office of Research and Development, National Engineering Research Laboratory, RTP, NC 27711.

18. George Allen, NESCAUM presentation on the aethalometer. http://bronze.nescaum.org/toxicsworkshop/Care_and_feeding_Aethalometers_Allen.pdf

19. Continuous Formaldehyde Standard Operating Procedure *(to be added before this Strategy document is final.)* .

20. Quality Management Plan and Data Quality Objectives Development. http://www.epa.gov/quality1/

21. Appendix A.DQO Development, Technical Assistance Document. http://www.epa.gov/ttn/amtic/files/ambient/airtox/drafttad.pdf

22. Information on VOCDat software tool, provided free by Sonoma Technology to the public, http://www.sonomatech.com/sti/software_projects_vocdat.htm

23. Office of Transportation and Air Quality website: information on rules and guidance documents. http://www.epa.gov/otaq/toxics.htm#regs

24. Listing of different MACT Standards and recent rulings. US. EPA Air Toxics webpage. http://www.epa.gov/airlinks/airlinks3.html

25. US EPA National Toxics Inventory. Final Version 3.0 for Hazardous Air Pollutants. http://www.epa.gov/ttn/chief/net/1999inventory.html

26. US EPA Technology Transfer Network: Links to State and Local Agency information. http://www.epa.gov/ttn/atw/stprogs.html

27. Quarterly Air Toxics Newsletters. http://www.epa.gov/ttn/amtic/airtxfil.html